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A MUNICIPAL SOLID WASTE RECOVERY STATION FEASIBILITY REPORT

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MONTANA DEPARTMENT of NATURAL RESOURCES and CONSERVATION

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A MUNICIPAL SOLID WASTE RECOVERY STATION FEASIBILITY REPORT

Prepared by

Matney Frantz Engineering
849 West Main
Bozeman, Montana 59715

(406) 586 3748

May 1985

Prepared for the

County of Beaverhead, Montana
Western Montana College, Dillon, Montana
County of Madison, Montana

and the

Montana Department of Natural Resources and Conservation
32 South Ewing, Helena, Montana 59620
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NOTE TO READERS

Certain statements in this report do not accurately reflect present conditions.

The volume of available municipal solid waste estimated in the report is 28 percent higher than estimated by the Montana Department of Health and Environmental Sciences, which has authority over solid waste facilities in the state. This underestimate is partly due to two more landfills being approved in Beaverhead County and taking part of the waste that otherwise would be available. Also, the estimated combustible fraction of the waste is 15 percent above what was experienced at the MSW burner in Livingston.

The price of natural gas now is $3.43/MCF, a full dollar less than used in calculations in the report.

Cost estimates do not include garbage transportation costs, tipping fees, and administration charges.

Ash produced by the facility could not be used as road fill and would have to be covered each night in the landfill.

All of these items tend to make the proposed facility look more feasible in this report than it really is.

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Introduction

June 1982, Western Montana College completed a preliminary study exploring the economic feasibility of generating steam from the burning of municipal solid waste (Preliminary Feasibility Study: Municipal Solid Waste to Steam Conversion at Dillon, Montana, Matney Frantz Engineering, June 1982). That study indicated:

> "...the economic and technical feasibility of the project described in this report is positive. Fairly conservative cost figures were used throughout and, even so, the project appears, under the assumptions used, to pay from the points of view of each of the major participants."

The results of that study and a growing concern with issues involving the disposal of county refuse has brought about the coalition of Madison and Beaverhead counties and Western Montana College (WMC), and led to this report.

This report has been prepared to:

1. Evaluate the aspects of municipal solid waste (MSW), and other possible supplementary fuels to be used, including volumes of solid waste available, collection, transportation, storage, disposal, burning and residue.

2. Review the potential life of the landfills throughout the study area, where possible, projecting future municipal waste from all reasonable hauling areas, and summarizing consequences of continued use of the present landfill sites.

3. Select a possible site for the location of a MSW recovery station and review legal and environmental restrictions.

4. Determine the kilowatt-hour buyback breakpoint of economic feasibility for electrical cogeneration, based on costs of the necessary equipment.

5. Select the mass burning system and equipment best suited for the incineration of MSW and the generation of steam. Discuss necessary support and auxiliary equipment.

6. Review sources for potential project funding.

7. Project the overall economic feasibility of an operative municipal solid waste recovery station.

The study area for this report includes Madison and Beaverhead counties and incorporated communities there. Western Montana College would be the recovery station's primary steam consumer. Implementation of this project would include construction of a municipal solid waste recovery station on or near the campus of Western Montana College at Dillon, Montana. The steam produced would be used to heat the WMC campus.

Two considerations which encourage this project are: first, the need to dispose of all solid waste properly, and second, the value of this waste as a fuel, replacing and/or supplementing conventional fuel sources.

With energy prices fluctuating, conservation technologies of all types are becoming increasingly attractive and effective. The economic benefits of this project would include savings generated by avoiding costly land acquisitions for landfills, preventing legal action against unlicensed dumping sites, avoiding contamination of water, soil, and air, and avoiding the costs of potential environmental restoration and clean-up.

Section One

Executive Summary

Introduction

This report reviews issues directly related to the economic feasibility of a municipal solid waste (MSW) resource recovery facility. The facility is to be located on the campus of Western Montana College, Dillon, Montana. Steam produced via the incineration of solid waste would be used to supplement the campus heating facilities.

The technology for producing energy through the incineration of municipal solid waste is a well established and proven technology. Analysis of the energy requirement at Western Montana College and the available volumes of MSW in Madison and Beaverhead counties, indicated that the best system for the specific conditions would be the use of a small modular heat recovery incinerator.

Both MSW and wood residues are available in sufficient volumes. The use of MSW has a secondary importance in that its use would alleviate some of the existing problems with current landfill sites.

Wood residue from a local mill, Stoltze Land and Lumber Company, is available, provided short term purchasing agreements can be developed. Wood waste would not be needed except during the winter when refuse availability would not keep pace with lower temperatures and higher heat demand.

According to the Montana Solid Waste Bureau, Beaverhead County has seven (7) Class II landfill sites, of which only one is unlicensed. Madison County recently countered its solid waste problems by implementing a container program. This program appears to be compatible with the proposed project in that it could simplify disposal problems, cut transportation cost, and supply the MSW recovery station.

Burning MSW has many health and environmental advantages. Currently available air pollution control technology can minimize potential air pollution problems associated with burning. Landfill operations, however, can not be made safe in unsuitable geological conditions, the case in some Beaverhead County landfills. Controlled burning seems to be the best option.

No known problems would result from the construction and operation of a recovery incinerator on the Western Montana College campus. The campus was chosen because the college is the only large scale steam user in the county.

This report contains several computer simulations of possible scenarios relating to the operation of the proposed incinerator. Estimated savings or cost are indicated for each scenario. The most economically feasible scenario requires incineration of all the MSW in Beaverhead County and the western portion of Madison County.

Most of the state requirements pertaining to this type of facility are administered by the Montana Department of Health and Environmental Sciences. Discussions with various bureaus in this department and review of the current laws indicated there would be no unresolvable problems. This report contains an overview of requirements and regulations.

Tax incentives and several possible alternative sources of funding for construction of the proposed facility are summarized in this report.

Findings

1. Some conditions at the Beaverhead County landfills must be resolved.

2. Beaverhead County should further investigate the possibility of implementing a container/transfer station program.

3. This project could be implemented so as not to damage the value and character of surrounding land.

4. The best apparent option is the incineration of all MSW from Beaverhead County and the western portion of Madison County. The simple payback of this scenario is approximately 6.9 years.

5. The estimated savings projected by this report fall within the margin for error, indicating that unforeseen events might make the project unprofitable. A decision to proceed cannot be based only on the results of the computer simulations presented in this report.

6. Success of the proposed project may pivot on avoided cost of legal actions and/or environmental degradation.

7. The economic projection could be improved if a portion of the front end construction cost could be paid with grant money.

8. Currently, campus utility bills for instructional buildings are paid from the Montana University System's general fund. Utility bills for dormitories are paid by the WMC budget. As savings from the proposed project would apply to each source, it may be appropriate for both sources to contribute funding in proportion to anticipated savings.

Section Two

Municipal Solid Waste (MSW)

Introduction

The purpose of this section is to determine if sufficient MSW is available to support the proposed project, how this MSW is currently being disposed of, and to identify supplementary fuels. The study area for the following analysis includes the waste generated in Madison and Beaverhead counties.

Two fuels have been identified for use in the proposed facility. The first is MSW. Disposal problems exist locally at present, thus a dual benefit in burning it. Transportation costs are the main obstacle. The second possible fuel is wood waste from local lumber mills. Three mills operate in the study area, but only one is large enough to make a significant fuel contribution.

The transportation reviewed in this report pertains only to existing landfill and container transfer stations. Refuse collection on a home-to-home basis is not considered in this report.

Municipal Solid Waste Volumes

The US Environmental Protection Agency estimates that the average American will generate 3.3 pounds of garbage per day; however, this figure will vary with population density as shown in the table below.

Table 2-1

Area Population Versus per Capita Waste

Pounds/Day

Municipality Size	Per Capita Daily Wastes
2-1,000	2.2
1,001-5,000	2.5
5,001-10,000	3.5
10,001 and up	4.5

Dearborn, RK, Resource Recovery, Advisory Committee Report to the Maine Board of Environmental Protection, Augusta, Maine, 1974.

Other sources indicate that rural settings, such as the study area, will produce approximately 2.6 pounds per day. The Comprehensive Solid Waste Management Plan for Madison and Lower Gallatin Counties, Robert Peccia and Associates (June 1979), concludes that:

> "...it is obvious that the energy available from the wastes generated in the study area are significant and the feasibility of utilizing these wastes as an energy source should be evaluated."

An additional phenomenon relating to pounds per day of production has been observed in Madison and other counties. Amounts deposited in collection receptacles increase after a tax assessment. "I'm paying for it, so I might as well use it," appears to be the philosophy.

The proper size for the proposed incinerator was based on the volume of available waste. A breakdown of the waste generation characteristics of the two counties is summarized in the following two tables. Non-processable waste such as demolition debris, inert materials and large bulky material which cannot be burned and must be landfilled, have been excluded.

Table 2-2

Madison County Container/Landfill Sites
Estimated Annual Waste (MSW) Available

Tons/Year

Location	Miles to WMC	Tons
Madison County	78	1,656
Twin Bridges	28	767
Norris	90	179
Harrison	105	180
Cardwell	47	1
Silver Star	41	1
Sheridan	38	657
Alder	50	236
Virginia City	65	223
Pony	105	107
Sub total		4,007
Less 10% Unburnables		400
Total		3,607

Note: Though the waste for Yellowstone National Park and West Yellowstone is delivered to the Madison County Landfill it has not been included in this table.

Table 2-3

Beaverhead County Landfill Sites
Estimated Annual Waste (MSW) Available

Tons/Year

Location	Miles to WMC	Tons
Beaverhead County	2	4,220
Wise River	55	167
Wisdom	71	230
Jackson	48	110
Grant	34	76
Dell	46	71
Lima	51	100
Sub total		4,974
Less 10% Unburnables		497
Total		4,477

The above volume of MSW does not remain constant over the year. The following table represents the approximate monthly percentages of the annual total. These ratios were extracted from Park County, Montana data and were used in this report for calculation purposes.

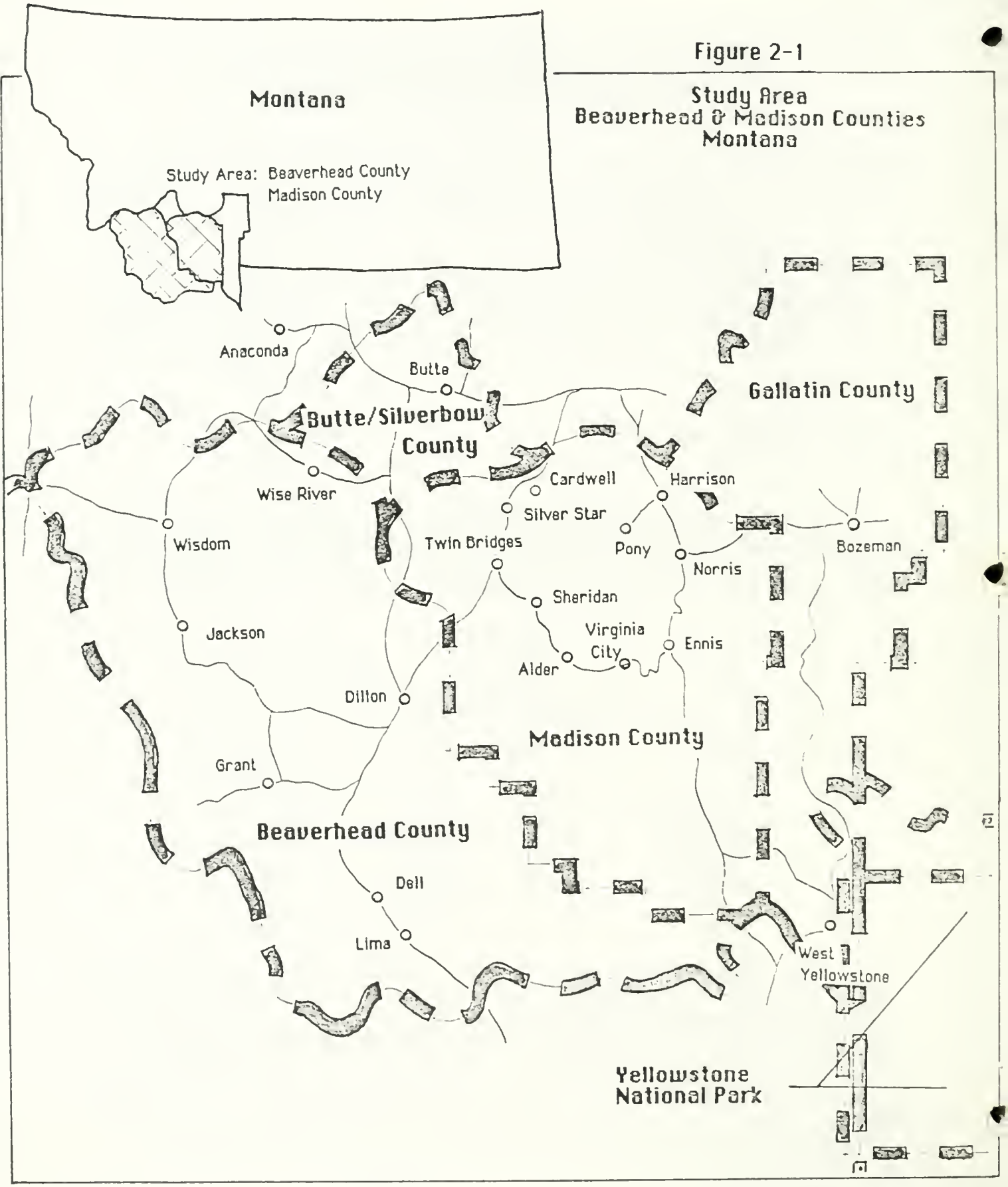
Table 2-4

Estimated Monthly Percentage
of Annual MSW Available

Month	% of Annual	Month	% of Annual
January	6.30	July	9.85
February	5.25	August	9.45
March	6.75	September	7.35
April	8.30	October	7.70
May	15.00	November	7.55
June	9.65	December	6.85

These ratios were extracted from the tonnage records of the Livingston recovery station. The waste from Yellowstone Park would imbalance this, increasing the summer load; however, since waste from the park is not included in the selected scenario(s), these ratios are used in the simulation. From the above table it can be noted that the high heating months (December, January, February) are the months with the lowest average volume of waste production. To fill the demand during the high heating-low MSW production months the possibility of using wood waste or of hauling MSW from outside the study area, specifically Butte, has been considered.

Figure 2-1


Study Area
Beaverhead & Madison Counties
Montana
Montana
Study Area: Beaverhead County
Madison County
Anaconda
Butte
Butte/Silverbow County
Gallatin County
Wise River
Cardwell
Harrison
Silver Star
Wisdom
Twin Bridges
Pony
Bozeman
Norris
Sheridan
Jackson
Virginia City
Ennis
Alder
Dillon
Madison County
Grant
Beaverhead County
Dell
Lima
West Yellowstone
Yellowstone National Park

Interstate 15 provides reliable access on a year round basis. Tuck McGree of McGree Trucking is currently under contract to Butte-Silverbow County to haul garbage. Fees for transportation with a driver would be $35/hour. Assuming a round trip of three hours and approximate waste conditions outside of the study area, the recovery facility at WMC could receive approximately eight tons of MSW daily from the Butte-Silverbow area. Long term contracts for winter hauling would have to be investigated with Butte-Silverbow and McGree Trucking before this could be considered a viable option.

Unburnables and "White Goods"

Approximately 90% of collected municipal solid waste is combustible. Currently, the Madison County Landfill accepts dead animals during the summer. Beaverhead County Landfill accepts no large dead animals. Large animals are picked up by rendering services during the cooler months, and the rest are buried. Both county sanitarians estimate the unburnables which must be removed, including white goods (washers, dryer, refrigerators etc.), animals, auto parts and unburnable construction debris at less than the percentages used for calculations in this study.

Existing Landfills

Landfills vary from large, organized, licensed facilities to small, haphazard, unauthorized dumping sites of small rural areas. All are important to regulating agencies charged with the responsibilities of air and water protection; however, within the scope of this study, the volume of burnable solid waste is the main concern.

Currently the waste generated in Madison County is being disposed of at a county-wide refuse district landfill located near Ennis. The waste generated in the county is transported to the county landfill through the use of a container/transfer system. This system was initiated in the summer of 1984 to replace open dumps. The analysis included herein evaluates the feasibility of transporting all or a portion of the MSW generated in the county to an incinerator at WMC.

Currently the waste generated in Beaverhead County is disposed of at six small satellite landfill sites located throughout the county and a larger sanitary landfill located near Dillon. The analysis included herein has assumed that the six satellite sites would be closed and that the MSW would be transported to either the Dillon landfill or to the incinerator at WMC.

Ten dumping/landfill sites are identified in Madison County, seven in Beaverhead. Included herein is a brief overview summarizing the conditions at these sites. Those sites identified in Madison County: Madison County Landfill at Ennis, Twin Bridges, Norris, Harrison, Cardwell, Silver Star, Sheridan, Alder, Virginia City and Pony. Those sites in Beaverhead County: Beaverhead County Landfill at Dillon, Wise River, Wisdom, Jackson, Grant, Dell and Lima.

Serious environmental problems are associated with most of these sites. All but one of Beaverhead County's authorized MSW sites are currently operating under a temporary variance. Many pose a threat to ground and surface water quality. From an ideal standpoint of geology and management practices, only the two county landfills should be maintained.

The Madison County Landfill is the only licensed operation in that county. At this time no major problems are visible with the landfill. Located near Ennis, the landfill should be distinguished from the old Ennis dump, which has been closed. This facility is operated in cells by the trench method. It is located on twenty acres of land leased from the Montana Department of State Lands. The county also holds an option to lease an additional twenty acres. This site has been in operation for two years. In addition to serving the local population and county, the site receives waste from Yellowstone National Park and the town of West Yellowstone in neighboring Gallatin County.

The loads from Yellowstone Park and West Yellowstone are delivered in seventy-five (75) yard compactor trailers with a four-to-one compaction ratio. This results in approximately 500 pounds per cubic yard, or between 16 and 20 tons per trailer. In the winter this trailer makes one to two trips per week. During the summer trips are made once or twice a day. The tipping fee at the county landfill is $3.50 per compacted yard, which works out to approximately $14.00 per ton. This hauling is done by Westgate Enterprises in West Yellowstone. The waste from the Yellowstone area has not been included in any of the scenarios because of transportation costs and the seasonal nature of the waste production.

Twin Bridges owns its own site. The location and soil conditions appear suitable, but it has never been operated in an organized manner.

The Norris site is located on the Red Bluff Experiment Station owned by Montana State University. The poor location poses a threat to surface water quality. There is open burning, no compaction and no regular covering.

The Harrison site is located on county property. Operations consist of digging pits and covering them when they are filled. This occurs approximately once a week. Soil conditions in the area are marginal for this type of land use.

The Cardwell and Silver Star sites are located on land owned by the state (currently being leased) and a Mr. Brown, respectively. Both sites are unlicensed and uncontrolled, generally a trespass situation. A trespass situation means that some or all users dump without permission of the controlling authority. The Cardwell site has been more or less abandoned. The Silver Star site has been fenced to limit access.

The Sheridan, Alder and Virginia City sites are owned by the City of Sheridan, Madison County and the Bureau of Land Management, respectively. All three sites are unlicensed and uncontrolled. They are poorly located and have potential for ground and surface water contamination. There is open burning. The operation of the Virginia City and Sheridan sites has been improved in the past year, but neither is approvable in its present location.

The Pony site is located on land under the jurisdiction of the Bureau of Land Management. It is unlicensed and uncontrolled with open burning; it is generally a trespass situation. The site has a high potential for ground and surface water contamination because it is located next to Pony Creek. It receives occasional maintenance by the county.

The Beaverhead County Landfill is owned and operated by that county and licensed by the state. It is located outside of Dillon. Some concern has been expressed by the Solid Waste Bureau about potential water pollution. The facility was started approximately forty years ago on eighty acres of land. It is operated on the area method of fill. County Sanitarian Eugene Regan has calculated a remaining useful life of approximately ten years.

The Wise River site is located on land owned by the Rafter Ranch. It is the only site in the county without state approval. The site is considered unacceptable for solid waste disposal because of permeable soils and consequent groundwater contamination potential. The site is just upstream of a Butte-Silverbow County water supply intake. The site is covered once a week. Occasional open burning has been observed.

For the first time in county history a rabid animal (skunk) was found in the Wise River site this year, resulting in a rabies quarantine for the county.

The Wisdom site appears to be on suitable soil conditions. It is located on private land owned by the Odmark Cattle Company. There is occasional open burning. It is covered approximately once a week. This site ran out of room in 1984, but additional land area has been donated by the Odmark Cattle Company for its continued operation.

The Jackson site is located on five acres of land currently being leased by Mr. Dick Hershey. It is a small site and the soil conditions appear adequate for such use. The site is covered approximately once a week.

The Grant and Dell sites are very small operations. They are owned by the Beaverhead Partnership Ranch and Mr. Weldon Bueler, respectively. The sites burn occasionally and are covered approximately once a week. The Dell site is almost out of ground area.

The Lima site is licensed by the Solid Waste Bureau. The City of Lima owns and operates the fill in a gravel pit. The site is burned on occasion. It was started on twelve acres of land in approximately 1977. Ten acres remain and its estimated useful life is about another 15 years.

Consequences of Continued Landfill Use

One option for eliminating unauthorized or unsanitary MSW disposal is to eliminate all but one landfill in each county and haul the MSW from elsewhere in the county.

The following tables show the estimated cost of this option.

The costs associated with the Beaverhead County site do not include the costs of transporting to the central site. It was assumed this would be handled by the private business sector. The costs associated with the Madison County Landfill, alternative, represent the cost to landfill all wastes that are transported from West Yellowstone annually. The costs used for the estimate are based on the following assumptions: first, no current facility exists and thus all necessary facility improvements would be required; second, each site would be sufficient in size to last for 20 years; and third, the capital cost would be amortized over 20 years at an annual interest rate of 12 percent.

Madison County has begun to consider locating a second county landfill in the western portion of the county. The economics of transportation cost savings and landfill operation cost of the new site versus transportation cost to Dillon will require further investigation.

It was necessary to calculate the annual operational costs for the two county-wide landfills. These costs are depicted in table 2-5. The costs used for the estimate are based on the following assumptions: first, a compactor would cover the waste with soil; second, the compactor would be operated at the end of each day the site is open, providing maintenance and soil cover over the MSW; third, a gate attendant would be on-site during operating hours to supervise dumping and keep general maintenance; and fourth, a subcontractor would excavate trenches.

Table 2-5

Sanitary Landfill
Estimated Capital Costs

		Madison County Landfill		Beaverhead County Landfill	
Item	$/Unit	Units	Cost	Units	Cost
Lands	$1,000/Acre	20	$20,000	15	$15,000
Fencing	$2.50/LF	3,300	8,250	3,000	7,500
Roads	$15/LF	1,000	15,000	1,000	15,000
Structures	$15/SF	1,000	15,000	1,000	15,000
Utilities			2,000		2,000
Contingency	20%		12,000		11,000
Total:			$72,250		$65,500
Amortization:			9,700		8,800

Amortization at 12% over 20 years.

The county sanitarians have estimated the useful lives of the Madison County and Beaverhead County landfills at 12 and 10.75 years respectively. Assuming that a portion of or all but unburnables were taken from the Madison County site to the recovery facility, the life of Madison County landfill would be extended from 12 to 50 years.

The estimated increase of the useful life of the Beaverhead County Landfill is substantially less. Useful life will depend on which scenario ultimately materializes. Worst case projections indicate only a 5 percent increase in the useful life.

All but one of the landfill sites in Madison County are unlicensed. State regulatory files are thick with records of past considerations and lack of proper management practices. As noted earlier, the Wise River site in Beaverhead is in a position to contaminate a portion of the water supply for the City of Butte. Continuing problems are well documented.

The political and legal situation concerning solid waste in both counties is uncertain. Some residents have initiated legal action against the Montana Solid Waste Bureau. The newly implemented container program in Madison County has been put in place, with a hopeful future of ending the illegal dumping of waste throughout the county. At the time of this report, many matters are on hold awaiting court action. From a regulatory standpoint, in consideration of legal, environmental and management concerns, this project may have far-reaching effects other than the simple economic and conservation effects. Transfer of all municipal solid wastes to the recovery facility at WMC would do away with many refuse disposal problems in both counties.

Table 2-6

Sanitary Landfill
Estimated Annual Costs

		Madison County Landfill		Beaverhead County Landfill	
Item	$/Unit	Units	Cost	Units	Cost
Maintenance			$2,000		$1,500
Equipment	$60/Hr	1,000	60,000	750	45,000
Utilities			1,000		750
Attendant	$6/Hr	1,640	9,800	1,430	8,580
Operators	$13/Hr	1,000	13,000	750	9,750
Trenches	$6/Ton	6,500	39,000	5,081	30,500
Sub Total:			$124,800		$96,080
Amortization:			9,700		8,800
Total Cost:			$134,500		$104,880
Cost per Ton:			$20.69		$20.64

The Madison County Landfill cost above includes the waste received from West Yellowstone. To determine the cost for disposing of the MSW generated in Madison County only, multiply the total annual cost by 0.60; that is the percentage of the total which Madison County is responsible for producing.

Wood Waste Volumes

Wood waste was the only fuel other than MSW that was considered. There are three wood mills in the area, one large enough for consideration as a fuel supplier. It is the Stoltze Land and Lumber Company located approximately 8 miles south of Dillon and Western Montana College.

The mill is currently under long-term contract for the sale of its sawdust and wood chips; however these agreements expire in 1987. Wood shavings are sold on an annual contract basis. Possible short-term (winter) contracts would have to be investigated further before these waste products could be considered economically available. For this reason wood waste was not considered in all of the computer simulations.

Wood residues (wastes) result from the manufacture of lumber, plywood, or similar products. This waste material is divided into three main categories:

1. Unmerchantable trees and downed materials,
2. Logging residues and waste, and
3. Residues and waste from the manufacture of primary products.

The amount of this wasted timber in Montana is enormous. The major obstacle to the first two supply sources is the locations at which they are found and the cost of gathering and transportation. Residue from manufacturing is available at every lumber mill.

Four types of wood waste would be available from the Stoltze mill: bark, sawdust, chips, and shavings. All waste is measured in "units" that are approximately 2,400 pounds.

Approximately 16 units of bark are produced per day and 7,500 units annually, with the current market price at approximately $3.50 per unit.

The mill currently loads its sawdust on railroad cars for transport and sale to Champion Paper of Missoula. The current market price is approximately $4.00 per unit. Sixteen units of sawdust are produced per operating shift, translating into 5,760 units annually.

Wood chips from the mill are taken by railroad to Lousiana Pacific Particle Board of Missoula. The price of wood chips fluctuates and has been as high as $40/unit recently. Currently the mill produces approximately 11,880 units of chips annually.

The price of shavings also fluctuates and has been between $3/unit and $5/unit. The mill produces 16 units of shavings per shift and 5,760 units annually.

All mill operations and production depend on the lumber market. The future is difficult to predict because of fluctuations in the housing market. Fuel can currently be purchased at approximately $4/ton for bark and $6/ton for shavings.

The other two mills identified in the study area are both in Madison County near Sheridan. They are small operations located 35 miles from WMC. Although fuel production may be insignificant now, future development in the area could turn them into significant fuel sources. These mills are: Goodman Logs, operated by Darrel Goodman, and Iron Rod Sawmill.

Section Three

Facility Location

Introduction

This section discusses the location of the proposed MSW incinerator and examines potential problems.

Site Selection

In the course of this study several sites were reviewed as possible locations. All of these were either on or immediately adjacent to the Western Montana College campus. Locations were limited to the college vicinity because it is the only potential year round user of the steam that would be produced.

Of the sites reviewed, two are on campus adjacent to the existing heating plant. One is northwest of the campus, across Atlantic Street. Three border the campus to the south and east. One borders the new Barrett Hospital, southwest of WMC.

Major Criteria

There are four major considerations that affect site selection:

1. Ownership of the land.
2. The cost of connection to Western Montana College.
3. Energy losses and operating costs.
4. Traffic and aesthetic problems.

1. Does the state or county own the land? Sites 1, 6, and 7 are owned by Western Montana College (a portion of site 6 is privately owned; WMC is currently trying to purchase the property). Site 1 is slated to become an industrial arts complex. Sites 2, 3, and 4 are owned by John Erb. Site 2, while still vacant, has been annexed by the city and has been plotted for subdivision. If a new swim center is built by Western, agreements have been made with Mr. Erb to give portions of sites 3 and 4 to the WMC. Site 5 is owned by Jean Stewart. It has recently been annexed by the city and has been plotted for subdivision development.

2. What is the cost to connect the recovery station to the WMC heating system? Connections from the proposed facility will be made to the current campus heating plant via insulated underground steam pipes. Connection to sites 1 and 2 would require excavation under Atlantic Street. Excation for site 5 would require disruption of Cornell Street and campus parking lots. Excavation for all other site connections would be relatively unobstructed.

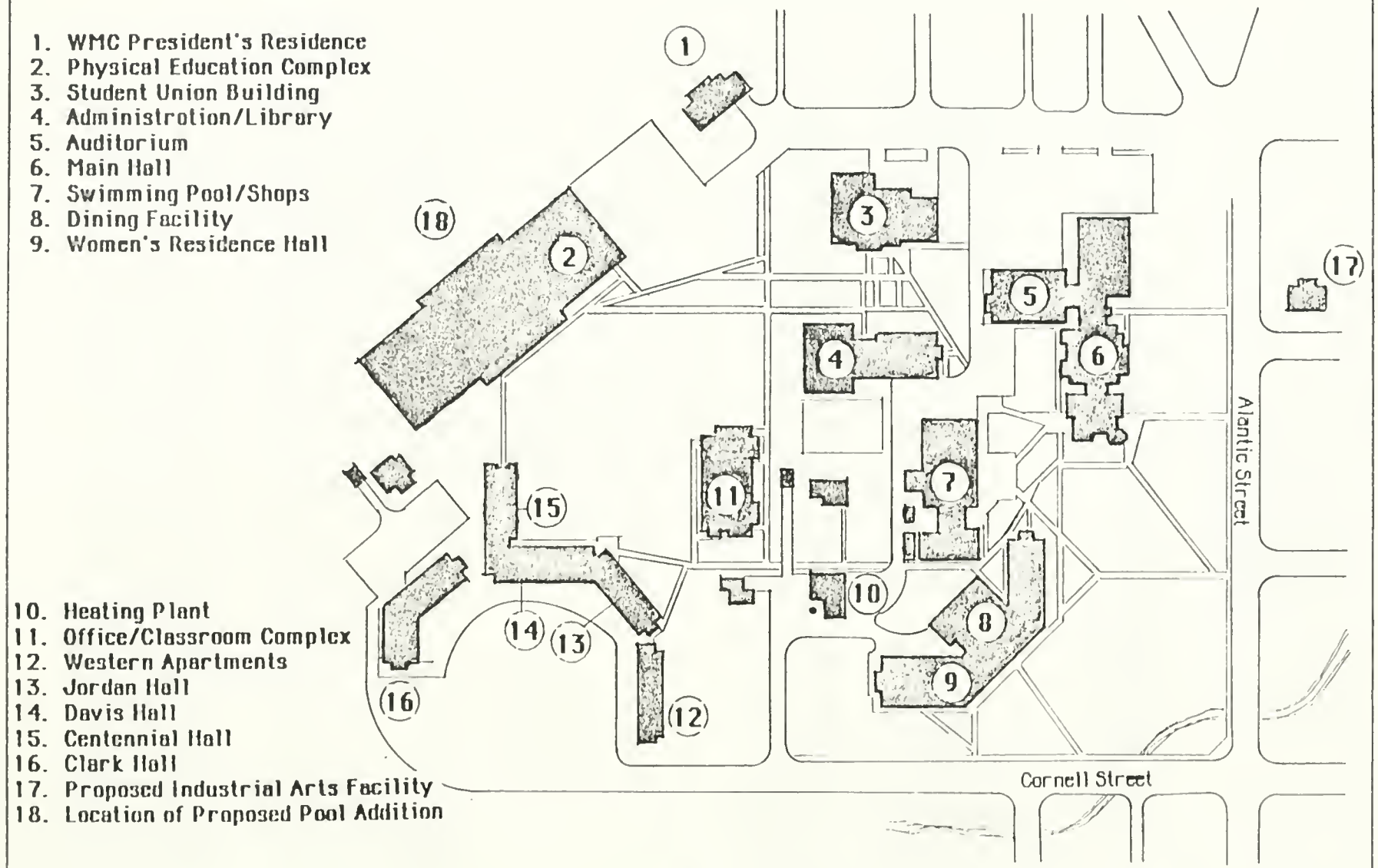


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Figure 3-1

Campus of Western Montana College
Dillon, Montana

Distances for connections may be reduced by connecting to existing steam system lines rather than directly to the existing heating plant; however, some existing lines have poor or no insulation. Pipe sizes also vary throughout the system and may prove too small in diameter to allow connection at the closest points.

3. How will energy losses and operating costs compare between the sites? Heat losses from steam and condensation return lines between the recovery station and existing heating plant vary proportionally with distance; the greater the distance the higher the loss. In comparison to all other sites, sites 6 and 7 will present a minimum of such losses.

It is assumed that college heating plant personnel will be charged with the responsibility of operation of the facility. Operations of the size projected require almost constant attention during the heating season. A distant location may necessitate additional personnel. The current staff consists of four firemen and a chief engineer. A distant location (sites 1 through 5) may require two or three additional staff positions for each shift.

4. What traffic and aesthetic problems are related to each site? No sites presented require truck traffic across the campus proper. Via the new interstate, traffic to sites 2, 3, and 4 will not have to pass through Dillon at all. Truck traffic to and from sites 1, 5, 6, and 7 will pass within Dillon city limits. It is recommended that truck traffic to sites 6 and 7 be from the south; entering Dillon city limits on Atlantic Street, turning east on to Cornell Street and, passing the women's dormitory turning on the access route being used by delivery vehicles to the dining facility.

The phrase "aesthetic problems" refers to: garbage, its visual and storage impact on the site, blowing litter, traffic and facility noise, and rodent and odor problems related to storing refuse. These conditions are facility dependent; occuring at any site that the recovery station is placed on. These aesthetic problems must be addressed in the facility design, by the design engineer, and in its management, by the staff.

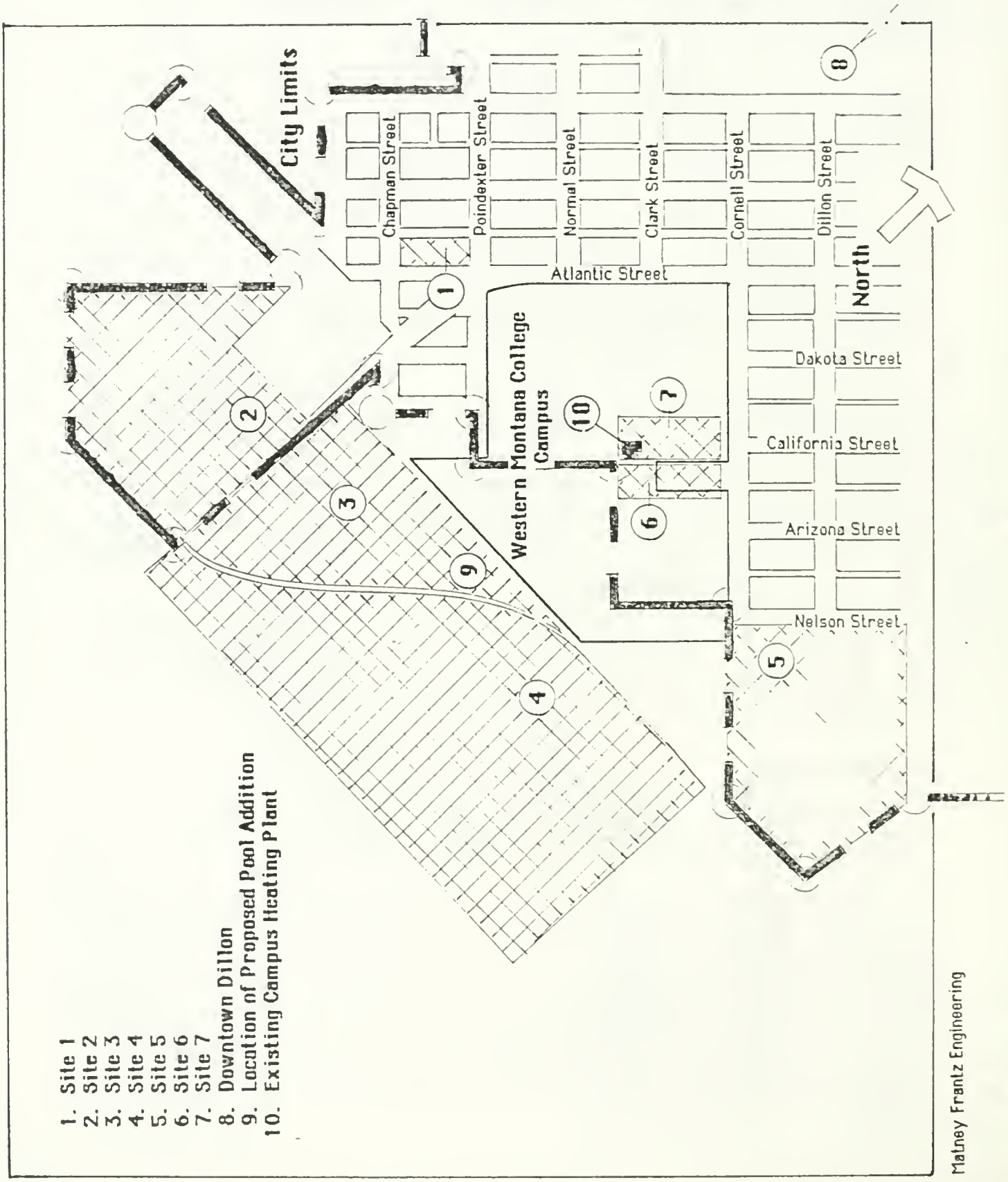
Individual Sites

1. Site 1: this is the only site considered with an existing (usable) building on it. The site and building was formerly a car dealership and is now owned by Western Montana College (WMC).

Construction is presently under way to make this site and building an industrial arts shop area for the college. The renovation was expected to be completed during the autumn of 1984 and the building put into service before the end of the 1984/85 school year. The distance to the present campus heating plant (over 380') is a disadvantage. The excavation for pipe and mechanical connections to campus, across or under a US Highway (Atlantic Street is now temporary US Highway 15) will be costly. Crossing under this roadway will expose the pipe and mechanical connections to all traffic and roadbed problems that may arise, thus causing additional expense and maintenance work.

Figure 3-2

Location Map
Possible MSW Recovery Station Sites
Western Montana College, Dillon, Montana



Traffic to and from this site would have a minimum impact on Dillon. All truck traffic to the site would arrive from the south on Chafman and Atlantic Streets, or temporary US Highway 15 and Atlantic Street (Atlantic Street and temporary US 15 separate at the corner of site 1).

2. Site 2: the owner of this site, John Erb, has plans for the development of a subdivision and a small commercial area. In discussing the possibility of WMC purchasing the land for a recovery station Mr. Erb stated he is not willing to sell. This ruled out any further consideration of the site.

3. Sites 3 and 4: these sites are also owned by Mr. Erb. Western Montana College is planning a swimming pool addition to the existing gymnasium building. Plans include a city entry to the complex from these sites. Mr. Erb has agreed to give WMC a portion of sites 3 and 4 to construct such a facility. In discussing the possibility of WMC purchasing the land for a recovery station Mr. Erb stated he is not willing to sell. This ruled out any further consideration of these sites.

4. Site 5: this site is currently owned by Jean Stewart. This land has been plotted for subdivision but there is currently no time table for its implementation. Conversation with Ms. Stewart indicated that she would consider selling the land to WMC.

A special problem at this site is the excavation and connection of piping. Almost the entire distance between site 5 and the heating plant (approximately 495') is roadway or parking lot. Excavation and repair would prove time-consuming and costly.

Truck traffic to this site would follow the current path of food delivery vehicles to campus. Instead of turning on to the existing heating plant access road, trucks would travel to the end of Cornell Street.

The site is currently undeveloped, and covered with natural grasses and vegitation. The entire site has been annexed by the city and zoned "A" Residence District.

5. Sites 6 and 7: because of their closeness in proximity, these two sites are being considered as one for the present, either of these sites is the recommended location of the recovery station. These sites satisfy all the criteria. Western Montana College owns the majority of the land, and agreements for the future purchase of the privately owned land are underway and seem likely. There is the shortest distance to be covered, minimizing costly underground pipe work and limiting line losses. These sites are close enough to the existing heating plant to allow centralization of heating equipment and facility and thus minimizing staff size. With the proposed recovery station being located here, on campus, great attention must be paid by the design engineer to the potential aesthetic and transportation problems.

Selected Site Area

As stated above, the preferred locations for this facility, at site 6 or 7, are between the campus heating plant and the Western Apartments married student housing. This area is indicated on the following page.

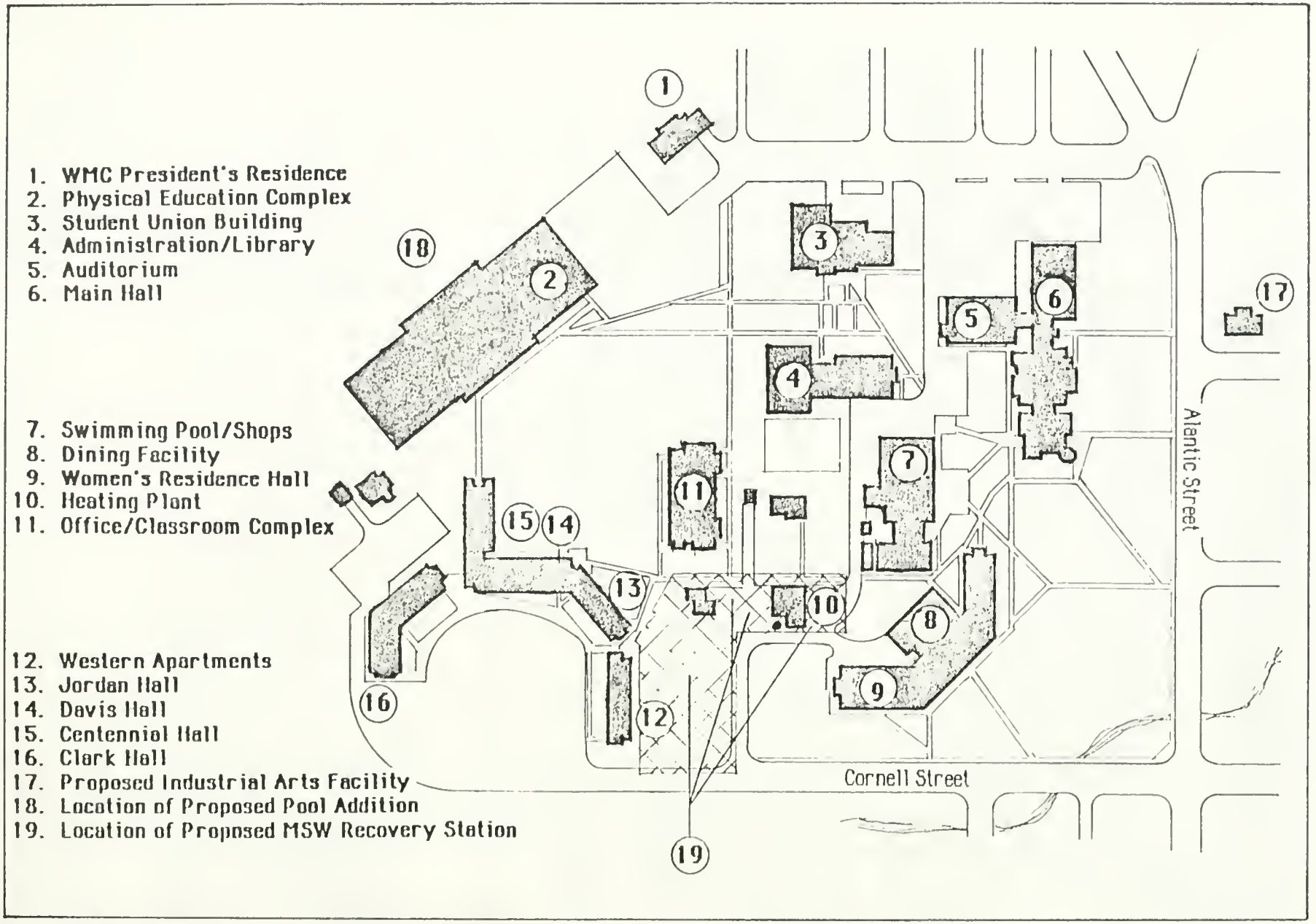


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Figure 3-3

Location Map
Recommended MSW Recovery Station Site
Western Montana College, Dillon, Montana

A portion of the land in the indicated area is owned by the WMC. The college is trying to purchase the remaining land; a small lot that penetrates campus from its Cornell Street access. If this parcel is obtained (it is a large portion of Site 6) it is strongly recommended that the facility be located here. Such action would require the removal of a small residence.

If the preferred location, Site 6, cannot be obtained, it is recommended that the facility be placed next to the existing heating facility, on Site 7.

Geology and Soil Conditions

A soil analysis of the site was not within the budget of this report.

From the limited information known, pilings are probably not necessary for building and equipment foundations. Further study will be required as the project approaches the design stages.

Topography, Landscape and Circulation

The ground area is basically flat. From the existing heating plant the ground slopes gently toward Cornell Street. The intersection of Cornell Street and the service road is slightly higher in elevation than Atlantic Street.

The site area is well covered with vegetation and large mature trees. The tress are primarily deciduous, but a handful of evergreens are scattered about. The heaviest concentration is along the creek, the green space between the Women's Residence Hall and the service drive, and between the siting area and Western Apartments. Because of their number and maturity, the view in any one direction is almost entirely broken up.

The residents along Cornell Street have planted brushy shrubs to limit the view and noise of campus.

The siting area is well serviced by both sidewalks and roadways. Cornell Street borders the entire northern side of the site; the existing heating plant's access road divides the site. The service road also appears to act as an emergency services access to the center areas of campus.

Almost all foot traffic in the area is to and from campus dormitories. The majority of this traffic is along the southern border of the siting area. Along the sidewalks running from Western Apartments and Jordan Hall to the swimming pool and dining facility.

The site area also is traveled by bicyclers; the service road which divides the site cuts two separate paths through the center of the campus.

Truck and car traffic on the site is mainly service and staff. Cornell street and the service drive are the delivery route both for food services delivering to the college dining facility and the lumber supplier delivering to the wood shops.

The site's service drive, Cornell Street, Atlantic Street, and temporary Interstate 15, all appear sufficient to handle the additional traffic demands of a MSW station.

There are four parking areas near or on the site. Service trucks, college-owned autos, and some staff private vehicles are parked on either side of the existing heating plant. There is staff and some student parking behind the Women's Residence, off the service drive from the site to the dining facility. Western Apartments stand between a larger parking area, east of the site, and the site itself. There is on-street parking along Cornell Street between Atlantic Street and the service road entrance.

Surrounding Waters

Across Cornell Street from campus is a small creek. It is within 500 feet of the proposed site, is open and runs year-round.

As noted above, the slope in this area is from campus toward Cornell and the creek; however, surface water drainage from rains and snow melt usually follow Cornell to Atlantic Street. No immediate concern appears necessary as long as any waste water discharge from the proposed plant is contained or controlled so as to avoid pollution of this water source.

Further investigation to determine an appropriate means of waste water disposal will be required as the project approaches the design stages.

Existing Structures

As indicated in an earlier drawing the site area is surrounded by various buildings. The two buildings most likely to be affected are the heating plant and the Western Apartments (married student housing).

The size and height of the surrounding buildings and trees draws the eye skyward. The heating facility's stack is a reference point from nearly anywhere on campus. This scale is broken by the two free-standing homes located on private land bordered on three sides by WMC.

All of the surrounding buildings are in use; all appear to be maintained and in sound condition.

Climate

The following weather information for the study area, specifically Dillon and Beaverhead County, was derived from Montana Solar and Weather Information (Morrison, SW, Western Sun, Portland, Oregon, September 1980).

Dillon's environment is fairly representative of many of Montana's intermountain valley climates. It is a interior high plateau, approximately 10 to 15 miles wide in this area, near-by mountains standing approximately a mile higher than the valley floor. The results of these conditions are pleasant summers and mild winters.

The summer climate is characterized by warm day temperatures and comfortable cool nights. Humidity problems are rare.

Because of the protection offered by the surrounding mountains the colds of deep winter seldom enter the Beaverhead Valley. Temperatures drop below zero in the Dillon area several times a year, but rarely stay longer than several days. The coldest recorded temperature of -36 F is well above the record lows of many other places in the state. Minimum temperatures of zero or below occur on an average of only 22 days a year.

The valley's freeze-free growing season averages 96 days annually; temperatures below freezing leave by the end of May and do not return until early September.

Precipitation records over a 30-year period at Western Montana College indicate an average annual precipitation of 11.41 inches. Large winter snowfall on the surrounding mountains produce ample water supplies throughout the valley. Of the annual average precipitation, 8.43 inches, 74%, falls as rain between the months of April and September. The wettest months are May and June. Excessively heavy rains are rare and brief. Snowfall in town is 38.8 inches a year.

Utilities

The incinerator facility would require access to water, sewer, street, telephone, electricity, natural gas and the college's steam distribution system. All utilities appear to be available to the location selected.

Zoning

The area is currently zoned as an Unrestricted District (Chapter 17.44, City of Dillon Zoning Ordinances); no problems are foreseen with complying. The area across from campus and Cornell Street is zoned "A" Residence District (Chapter 17.28).

Quality and Character of Surroundings

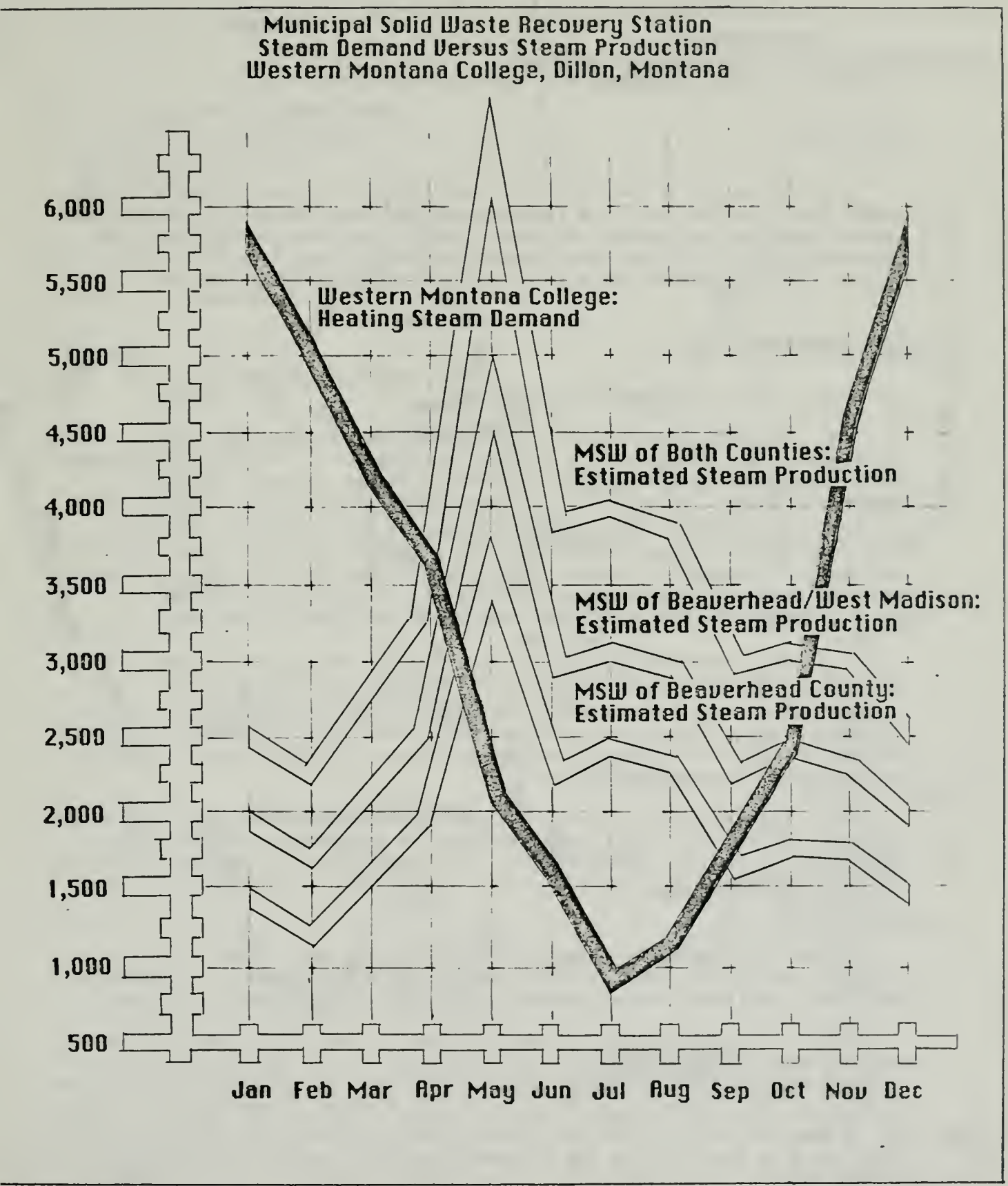
The noise generated by a recovery station would not be greater than that of the current boiler facilities; with one system replacing the other a majority of the time, the noise would remain at the same level.

A negative pressure would be maintained in the building with combustion air intake fans so that odors and gases can be drawn into the incinerator, burned, and exhausted out the stack.

Maintaining a schedule of allowable delivery times would minimize truck traffic impact on the surrounding areas. All dumping of refuse from the trucks will be conducted inside the recovery facility.

A properly designed recovery station would comply with all occupational health and environmental pollution standards.

Figure 4-1



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Section Four

Fuel and Facility Scenarios

Introduction

To determine the feasibility of using MSW as an energy source at WMC, scenarios of various possible fuel sources and their volumes were developed, investigated and evaluated. For each scenario the total system cost was approximated or calculated and compared to the estimated cost of not implementing the project at all. These analyses are summarized below.

Scenarios Considered

The most pratical options are as follows:

1. Beaverhead County only: in this scenario, only the waste generated in Beaverhead County would be incinerated at the Western Montana College recovery facility. For this option it was assumed that the satellite landfill sites currently in operation in Beaverhead County would all be closed and that MSW usually disposed of there would be delivered either to the Beaverhead County Landfill or to the MSW incinerator. Since the cost of transportation from the outlying areas to Dillon would be about the same whether the waste was incinerated or landfilled, the cost of transportation was not considered as part of the total system cost.

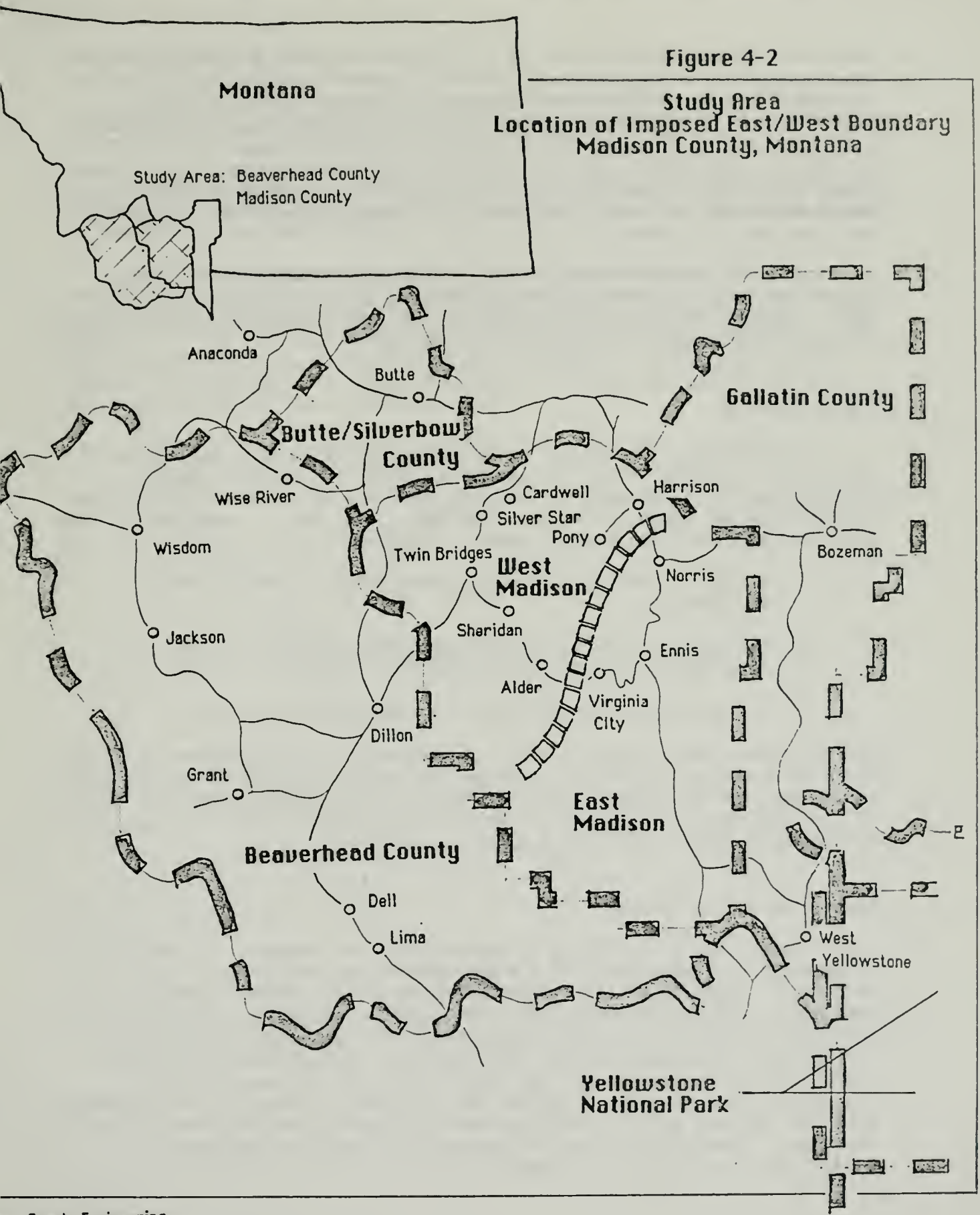
2. Beaverhead County and Madison County: this option assumes that the MSW generated in both Madison and Beaverhead counties would be transported to and incinerated at the facility on the Western Montana College campus. This scenario is not considered to be economical. Transportation costs from the eastern portions of Madison County over the mountains would be too expensive.

3. Beaverhead and the western portion of Madison County: this option assumes that the municipal waste generated in Beaverhead and the western half of Madison would be incinerated. The waste from the eastern portion of the Madison County would continue to be transported to the county landfill near Ennis.

The system costs for the above three options are presented in the computer simulations located in Section Eight of this report. It appears that even the least costly scenario would not produce dramatic savings.

It is assumed that the steam generated by the burning MSW would be used to heat the Western Montana College campus. The following graph depicts the approximate volume of steam that could be generated by the three options given; assuming conversion of 1 ton of MSW to 5,000 pounds of steam. It is apparent that the WMC campus steam-heating demand exceeds the steam that could be generated by the proposed facility, especially during the winter months. Conversely, the volumes generated during the spring and summer exceed campus demands.

Figure 4-2



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Therefore, it was assumed that the existing WMC heating plant would shut down during the spring and summer, with all needed steam being produced by burning refuse. During the fall and winter heating seasons, both the existing plant and new facility would be used to meet steam requirements, with the existing plant providing whatever was needed above the MSW incinerator production. If the necessary short term agreements with local lumber mills can be made for sufficient amounts of wood waste, MSW and wood waste would meet the steam requirements of campus independent of the existing heating plant.

Currently Western Montana College does not break down its budget sufficiently to identify all of the component costs of generating steam heat. Because of this, savings could not be specifically calculated and the computer simulations rely on estimated savings.

Energy Balance

A net energy analysis was conducted to determine what percentage of the energy available in the fuel would be recovered for each resource recovery option investigated. Generally, MSW has an average heating value of 5,000 Btu per pound (10 million Btu/Ton). When MSW is converted to steam there are three primary energy losses. These are:

1. The 50% of the total heating value which is lost to boiler efficiency.

2. The small volume of natural gas necessary to start and occasionally assist the incineration process.

3. The electricity requirements to operate the facility.

Besides these losses, approximately 25 percent of the total steam generated would be discharged to the air because the supply of steam during the summer far exceeds WMC's demand. Based on the parameters stated above, one third of the total Btu available in the MSW would be used. Other steam generation systems have similar efficiency rates.

Generation of Electricity

Since there is a surplus of steam during the summer, the feasibility of generating electricity with a steam turbine was evaluated. The additional capital cost to provide the necessary equipment is approximately $120,000. When the amortization of this capital expenditure is added to the increases in operation and maintenance costs, it was determined that a "break-even" or buyback rate of nine cents per kilowatt-hour ($0.09/KWH) would be necessary to pay for the added costs. This compares to an incremental rate of under $0.02/KWH for the campus. Thus, it is recommended that the recovery facility not include electrical generation capabilities at this time. However, any facility should be designed so that such capabilities could easily be added.

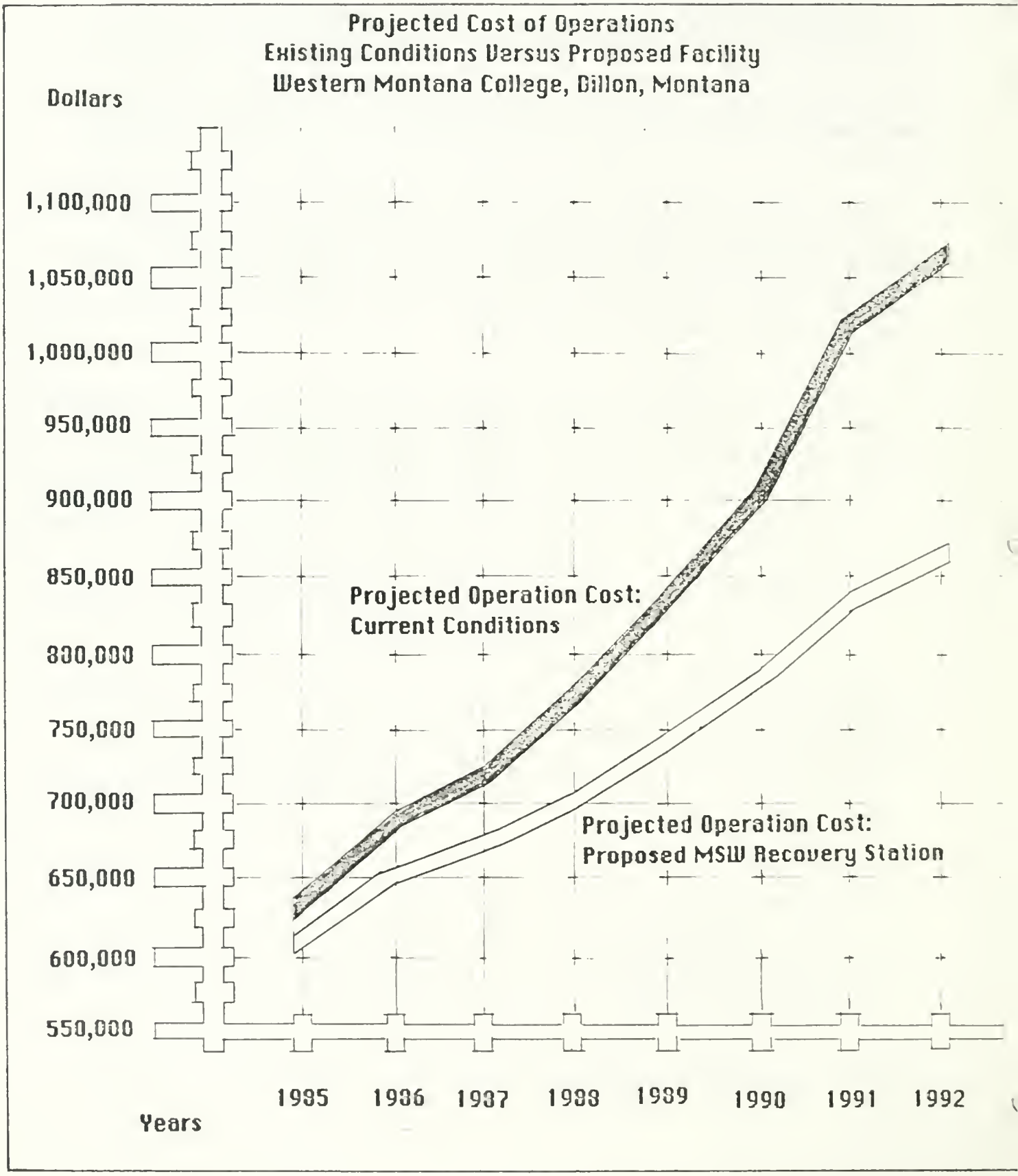
Energy Assumptions Used

Throughout this report many calculations were made, all of the assumptions will either be identifed in text or can be found listed in an appendix.

All assumptions and calculations affecting the simulation program are discussed in Section Eight or listed in an appendix. The simulation program is assumed to have approximately a 10% margin of error.

All of the computer simulations assume "1984/85 Dollars." However, the following graph takes the Beaverhead and western portion of Madison County scenario and shows the estimated increases in operation costs. The costs are of current operations and a MSW Recovery Station handling refuse from Beaverhead County and western Madison County. Cost projections are based on Montana Power Company estimates for natural gas and electricity price increases over the next seven years.

Figure 4-3


Projected Cost of Operations
Existing Conditions Versus Proposed Facility
Western Montana College, Dillon, Montana
Dollars
1,100,000
1,050,000
1,000,000
950,000
900,000
850,000
800,000
750,000
700,000
650,000
600,000
550,000
Projected Operation Cost:
Current Conditions
Projected Operation Cost:
Proposed MSW Recovery Station
1985
1986
1987
1988
1989
1990
1991
1992
Years

Section Five

Mass Burner System

Introduction

The current cost of electricity in the study area as well as the additional cost of equipment has made the production of electricity an uneconomic option at this time. This section will discuss the type of system/equipment that will produce steam in the most favorable manner for project success.

Existing Heating Plant Boilers

The existing heating plant, which houses four boilers, is located approximately in the center of campus. A fifth campus boiler is located in the Student Union Building. These boilers are:

Boiler #1: A 300 horsepower Kewanee Firetube Boiler, Serial Number MTB 03506, State of Montana Number 18-1.

Boiler #2: A 300 horsepower Kewanee Firetube Boiler, Serial Number MTB 03507, State of Montana Number 18-2.

Boiler #3: A 300 horsepower Kewanee Firetube Boiler, Serial Number MTB 03508, State of Montana Number 18-3.

Boiler #4: A 500 horsepower Scotch Marine Boiler, Pawnee Model A-500, Serial Number 4436.

Boiler #5: A Burnham Cast Iron Boiler, Serial Number MTB 07801 (Student Union Building).

All four boilers in the heating plant have 2 to 3 inches of insulation. All five boilers were inspected on the 16th day of July, 1984 by David Swallow of Public Risk Insurance Management, Incorporated. Mr. Swallow's comments were:

> Boiler #1: This boiler was inspected externally as far as construction would allow. The vessel's low water fuel cutoff control was tested and it operated properly. No signs of weakness, leakage, or other adverse conditions were noted at the time of inspection.

Boilers #2-4: These boilers were inspected internally as far as construction would allow, with the low water fuel cutoff controls being dismantled. Scale conditions inside the boilers appear light with no evidence of active corrosion being noted. No signs of weakness or other adverse conditions were noted at the time of inspection.

Boiler #5: This boiler was inspected externally in a standby condition as far as construction would allow. The low water fuel cutoff control's float assembly's working parts, electric switch and wiring were noted in good condition at the time of inspection, with the relief valve being free in movement. No signs of weakness, leakage, or other adverse conditions were noted.

Boiler #5 provides heat for the Student Union Building only and is independent of the rest of the campus' heating system. This project will not effect Boiler #5 and it will not be addressed further in this report. Should it be possible in the future to obtain the additional waste fuel necessary to increase the energy output of the recovery station it may prove feasible to provide heat to this building, and eliminate the need for this boiler.

During the winter heating season of 1983/84 the plant personnel used only Boiler #4 to meet the campus' heating demands. The other three boilers were taken off line. Only boiler #1 was used through the summer of 1984. Plans for the winter heating season of 1984/85 were to heat with Boiler #1, with #2 on line as a support and backup boiler. Boilers 1 thru 3 individually can meet all of the campus' demands throughout the day provided the temperature is not continually below zero Fahrenheit. Normally, two boilers are necessary to provide enough steam to carry the campus' buildings through the night. New insulated steam lines from the heating plant to the library and student housing were installed during the summer of 1984. Such improvments increase the system efficiency and reduce energy demands; both these items increase the possibilities that an MSW incinerator could meet a large portion of campus heating demands.

It is estimated that the four main plant boilers have a useful life of twenty-five years.

If the proposed incinerator can be designed to meet 17,250 pounds of steam per hour, the capacity of boiler #4, then it would normally be able to meet the entire campus demand for heat.

Description of MSW Incineration Equipment

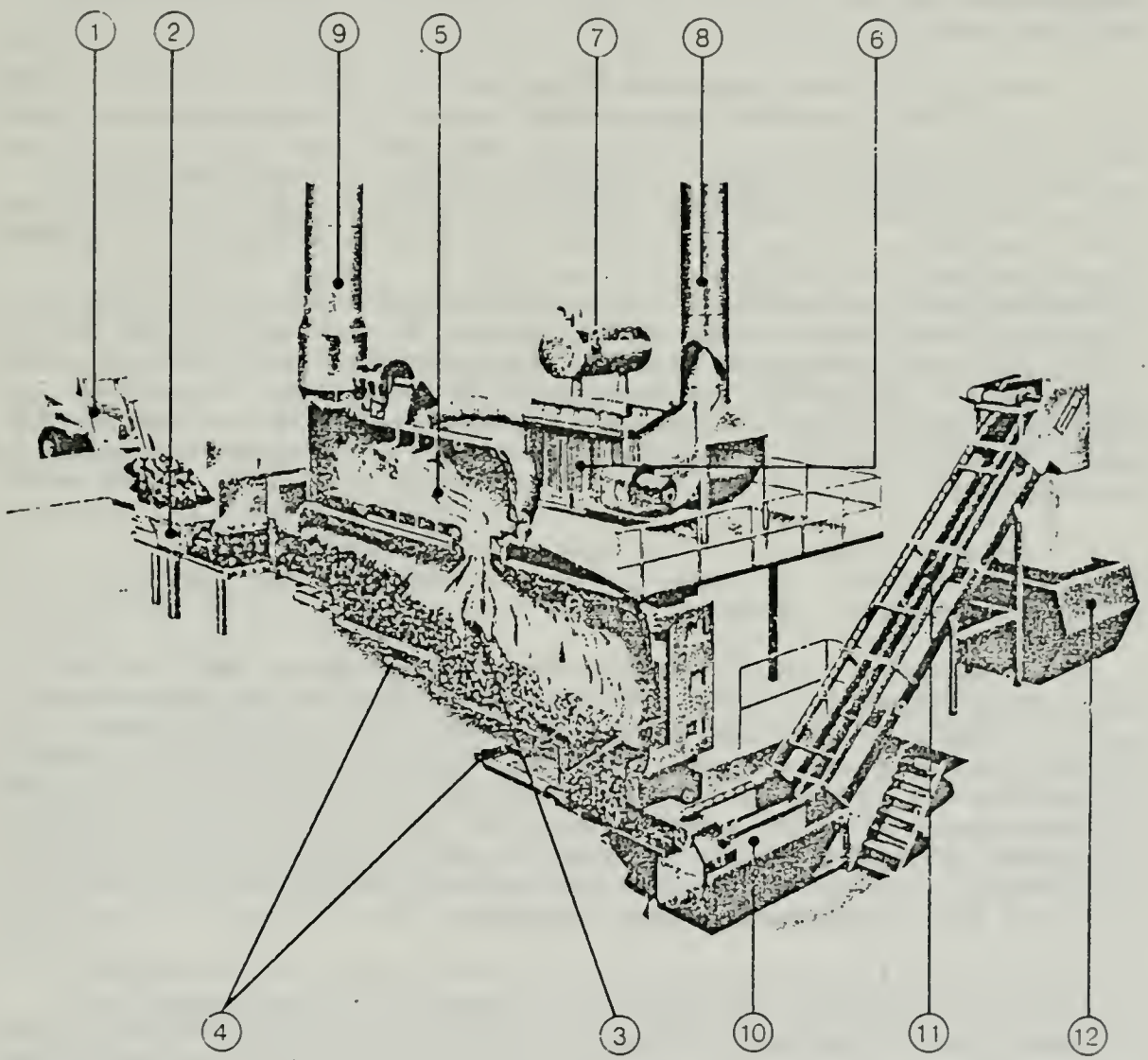
The most applicable waste-to-energy system would be a small modular heat recovery incinerator. These types of systems do not require a high degree of initial waste processing, nor do they require large quantities of wastes to be economically feasible. These systems are normally supplied in modules ranging in capacity from 10 to 250 tons per day.

Figure 5-1

Typical Modular Incinerator
Consumat Systems, Incorporated

e drawing below shows the stand-
l CONSUMAT™ arrangement for
ngle processing modules. The load-
g arrangement is typical in munici-
l and large industrial applications.

Other loading options available include such CONSUMAT™ standards as automatic cart dump, pneumatic, conveyor belt, and direct dumpster discharge systems. CONSUMAT™ factory engineers can supply you with details to match your specific installation requirements.



e above cutaway view of the stand-
d CONSUMAT™ energy-from-waste
odule shows how material and hot
s flows are controlled to provide
eam from solid waste. A skid steer
actor (1) pushes the waste to the
tomatic loader (2). The loader then
tomatically injects the waste into
e gas production chamber (3)
here transfer rams (4) move the
aterial slowly through the system.
he high temperature environment in the gas production chamber is provided with a controlled quantity of air so that gases from the process are not burned in this chamber but fed to the upper or pollution control chamber (5). Here the gases are mixed with air and controlled to maintain a proper air fuel ratio and temperature for entrance into the heat exchanger (6) where steam is produced. A steam separator (7) is provided to ensure high quality steam. In normal operation gases are discharged through the energy stack (8). When steam is not required or in the event of a power failure, hot gases are vented through the dump stack (9). The inert material from the combustion process is ejected from the machine in the form of ash into the wet sump (10) and conveyed (11) into a closed bottom container (12) which can then be hauled to the landfill for final disposal.

Since modular units can be operated independently or simultaneously this type of system was considered essential for efficient operations. This "unit independence" will allow any possible scenario of firing between the existing boilers and the incinerator equipment; and would ease scheduled and unscheduled maintenance of each system.

The modular units suggested for use in this facility are pre-constructed with integral components. Each unit will be assembled independently in the factory, delivered to the site ready for immediate installation.

This type of energy recovery system was first built in the late 1960s. Since that time major modifications have been made. The systems that have been installed within the past few years have added heat recovery units and automatic ash removal systems. Basically, modular incinerator systems consist of a primary combustion chamber, a secondary combustion chamber and a heat exchanger. The units are fed by a mechanical or hydraulic ram that charges the material to be used as fuel onto a fixed bed. The waste is ignited by use of an auxiliary fuel until temperatures allow self-sustaining combustion. Combustion in the primary chamber is usually in a starved air atmosphere. An advantage of this is that a high particulate exhaust is not generated. The combustion gases generated in the primary chamber are completely combusted in the secondary chamber with the aid of auxiliary fuel. The hot gases are passed through a fire tube or water tube boiler for heat exchange.

Currently there are five primary firms that market modular incineration systems. Included herein is a summary of each system's operation and system components.

1. Basic Environmental Engineering, Incorporated: Basic incinerators use a three-stage incinerator. The corporation has had greatest success using an eighty-five percent (85%) alumina refractory, although other refractories have been used. The charging system is mechanically driven with a rack and pinion system. The firm primarily proposes the use of heat recovery equipment in the primary combustion chamber. According to Basic officials, the system is also designed to burn coal, wood waste and other solid fuels. The ash removal system consists of refractory line and doors that open and dump ash into a receiving bin.

2. Clear Air, Incorporated: Clear Air employs a three-chamber incinerator system that uses excess air. Because of this design, air pollution control devices are required. Fire brick is used in the primary chamber. A movable grate transfers the waste to the primary chamber. The movement of the grate transports the waste to the rear of the chamber where a conveyor moves the ash to a quench tank and hopper. The system's heat recovery system consists of a fire tube boiler.

3. Comtro Division, Sunbeam Equipment Corporation: Comtro uses a starved air system in which waste is charged into the combustion chamber by a hydraulically operated ram. The company has used several fire tube boilers for heat recovery including those manufactured by Eclipse, Kewanee and ABCO. The ash handling system consists of a water-sealed hopper with a conveyor that transports the ash to a disposal container.

4. Consumat Systems, Incorporated: Consumat systems operate on a

starved-air principle in the primary combustion chamber. The fuel gases are completely burned in the secondary chamber by auxiliary fuel. The heat exchanger consists of a water tube boiler with fins placed in the unit to maximize recovery efficiencies. In more recent installations an automatic ash removal system has been included. With this system a ram ejects ash into a receiving hopper where it is quenched and displaced into a pit area. The ash is then conveyed to a disposal container.

5. Kelly Company, Incorporated: The Kelley system operates on a starved-air principle. The waste is charged into the combustion chamber by use of a hydraulically driven ram. Kelley has used York-Shipley tube boilers for heat recovery in the past. The ash removal system for municipal applications consists of two rams positioned below the feed ram and a sliding door that accepts the ash into a water-quenched chamber.

Other manufacturers in this field are: Burn-Zol, CE Bartlett, Econotherm, ECP, Giery, Lamb-Cargate, Morse-Boulger, SEE, Simonds, Smokatrol, and Washburn.

Based on the investigations made for this project, it was determined that at the present time the modular systems designed by Consumat Systems appear to be the most technologically advanced and proven for the application considered here. Thus equipment sizing and cost estimates included here are based on the installation of a Consumat system. It should be noted, however, that if a MSW recovery facility is approved, a detailed investigation should be conducted to evaluate all prospective equipment suppliers and/or manufacturers.

Size and Operation

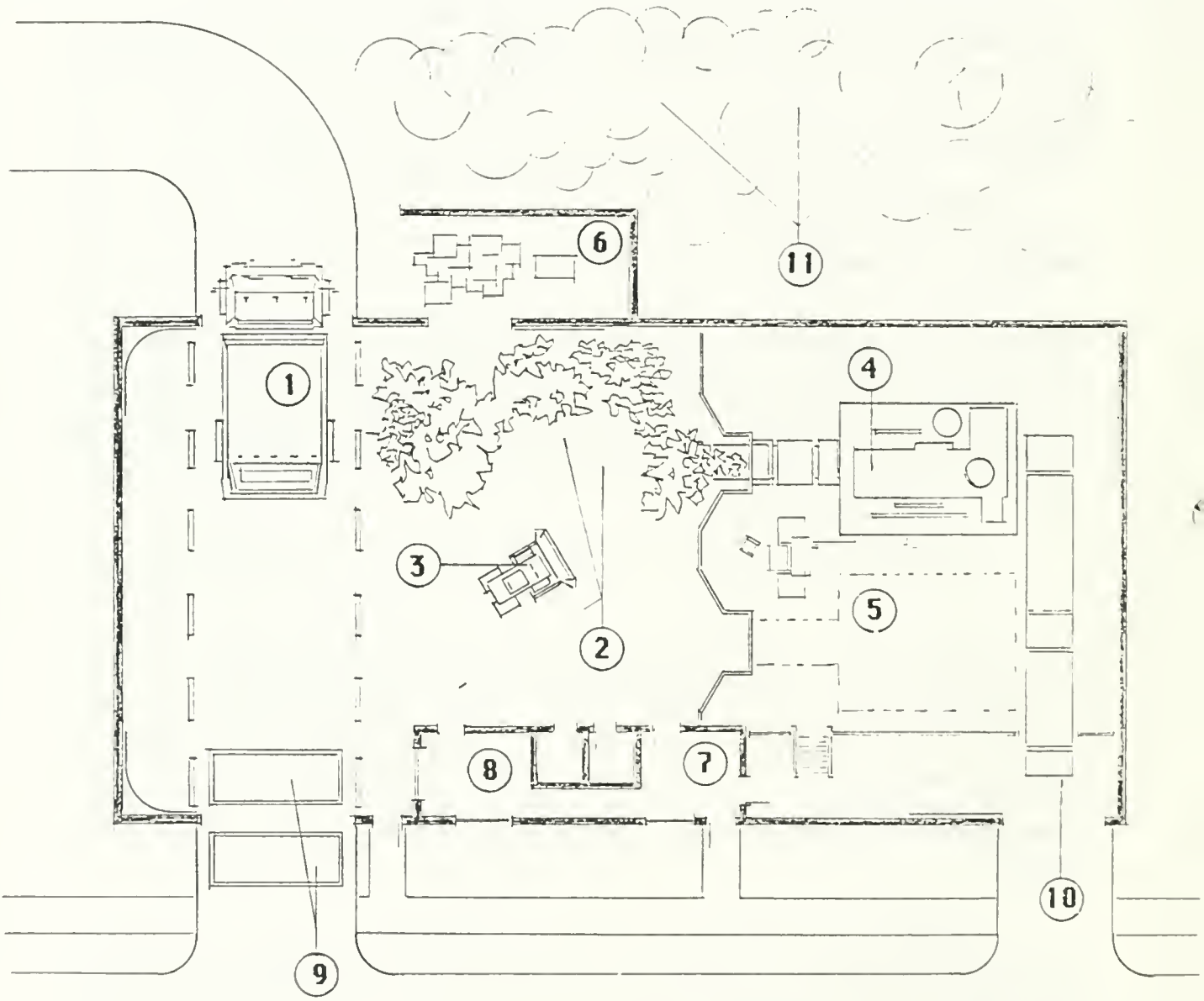
It was determined that the incinerator would have to be one of two sizes, depending on the fuel supply option chosen. For the option in which all of Madison and Beaverhead counties' waste could be incinerated, it is recommended that the incinerator be rated at 32 tons per day (two 16 ton/day units), with a single building that would house the tipping floor (dumping area) and the incinerator/heat recovery systems. The building would be ample in size to store a two-day accumulation of MSW, or perhaps three. The receiving area would be designed so that both private individuals and municipal and commercial refuse haulers could deposit their waste at the facility.

Solid waste would be dumped directly onto the tipping floor in the structure. The waste could then be moved, stacked and/or placed into the incinerators by gas or diesel-operated loaders. The refuse would be charged by a ram into the incinerator where it would be burned. The ash would be conveyed and/or dumped from the incinerators into roll-off containers located in the building. From here the ash would be hauled to the Beaverhead County Landfill for disposal. The existing landfill would remain operational to accept ash and unburnables and to take burnable solid waste when the incinerator is not operating.

For options that would use less MSW, it is recommended that a smaller facility be constructed. This facility would include a 20 ton/day incinerator rather than two 16 ton/day units. The building would be smaller and consist of approximately 5,000 square feet rather than 8,000 square feet. Possible siting of this facility is discussed in this report.

Figure 5-2

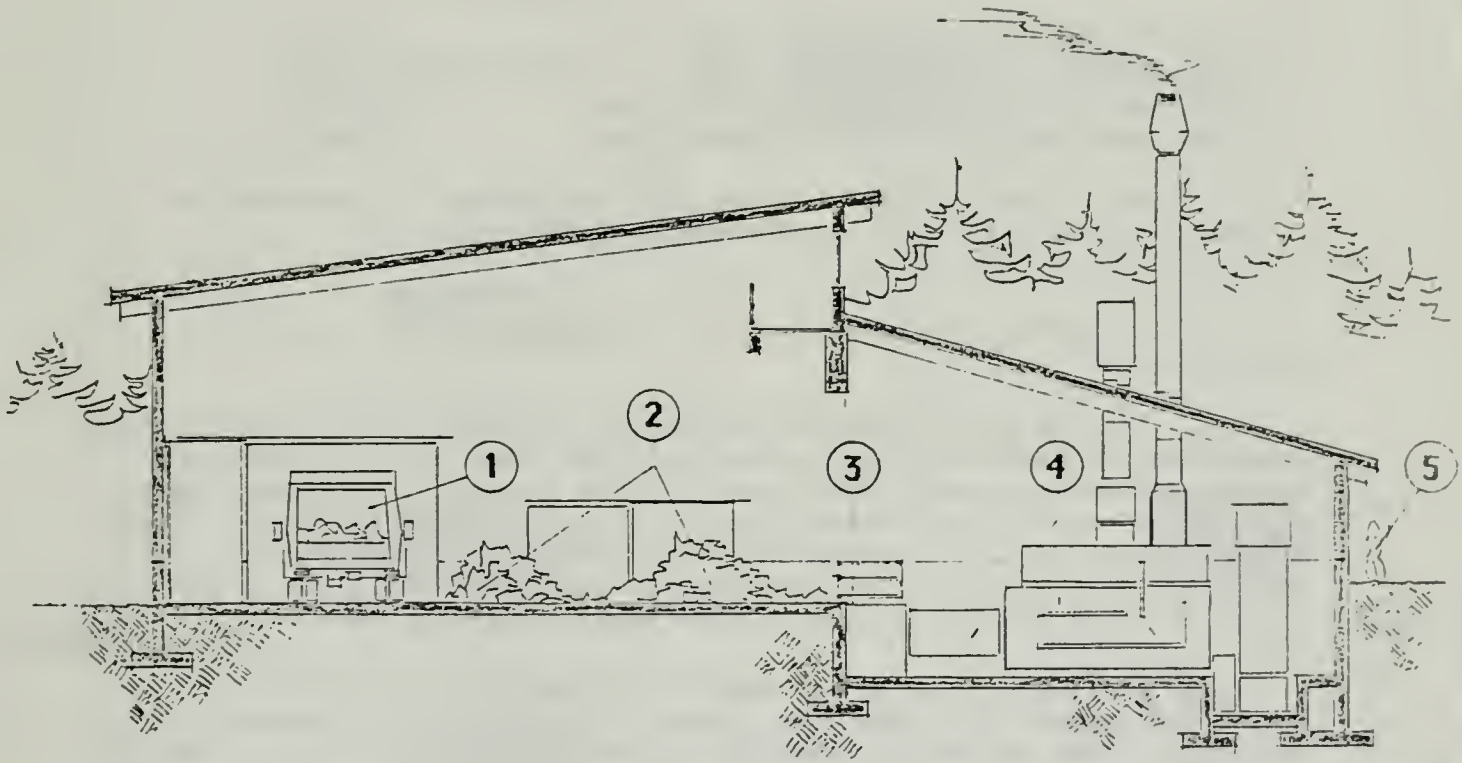
Municipal Solid Waste Recovery Station
Diagramatic Building Floor Plan
Western Montana College, Dillon, Montana



1. Garbage Truck
2. Tipping Area/MSW Storage Area
3. Tractor
4. Modular MSW Incinerator
5. Future Modular MSW Incinerator
6. Bulk Waste Storage Area
7. Incinerator Control Office
8. Receiving Office
9. Scales (only one necessary)
10. Ash Pickup/Removal Point
11. Planting

Figure 5-3

Municipal Solid Waste Recovery Station
Diagramatic Building Section
Western Montana College, Dillon, Montana



1. Garbage Truck
2. Tipping Area/MSW Storage Area
3. Incinerator Loading Point
4. Modular MSW Incinerator
5. Student

Either size facility would operate 24 hours a day, seven days a week except during planned or unplanned down-times. For facilities such as this, the following schedule should be planned for, allowing two weeks for routine maintenance and estimating unscheduled down-times at 10% of operation. It is anticipated that during the down-time periods, the Beaverhead County landfill would be used to dispose of the wastes.

Table 5-1

MSW Recovery Facility
Estimated Operation Time

	Hours/Year
Total scheduled operation per year	8,760
Total scheduled down-times per year	336
Estimates unscheduled down-times per year	842
Total availablity for operations per year	7,582

The total estimated time that the facility will be in operation per year is then figured at eighty-seven percent (87%).

The following is a brief summary of the major stages of the incineration.

1. Feeding and the feeding mechanism: at controlled intervals, based on temperature readings of the combustion conditions in the primary and secondary chambers, waste to be burned is fed into a loading hopper by an operator. From here an automatic ram will begin pushing the waste into the primary chamber as it is called for by controls. It is usually not necessary for the waste to be preprocessed before it enters the primary chamber, except for the removal of any large noncombustibles.

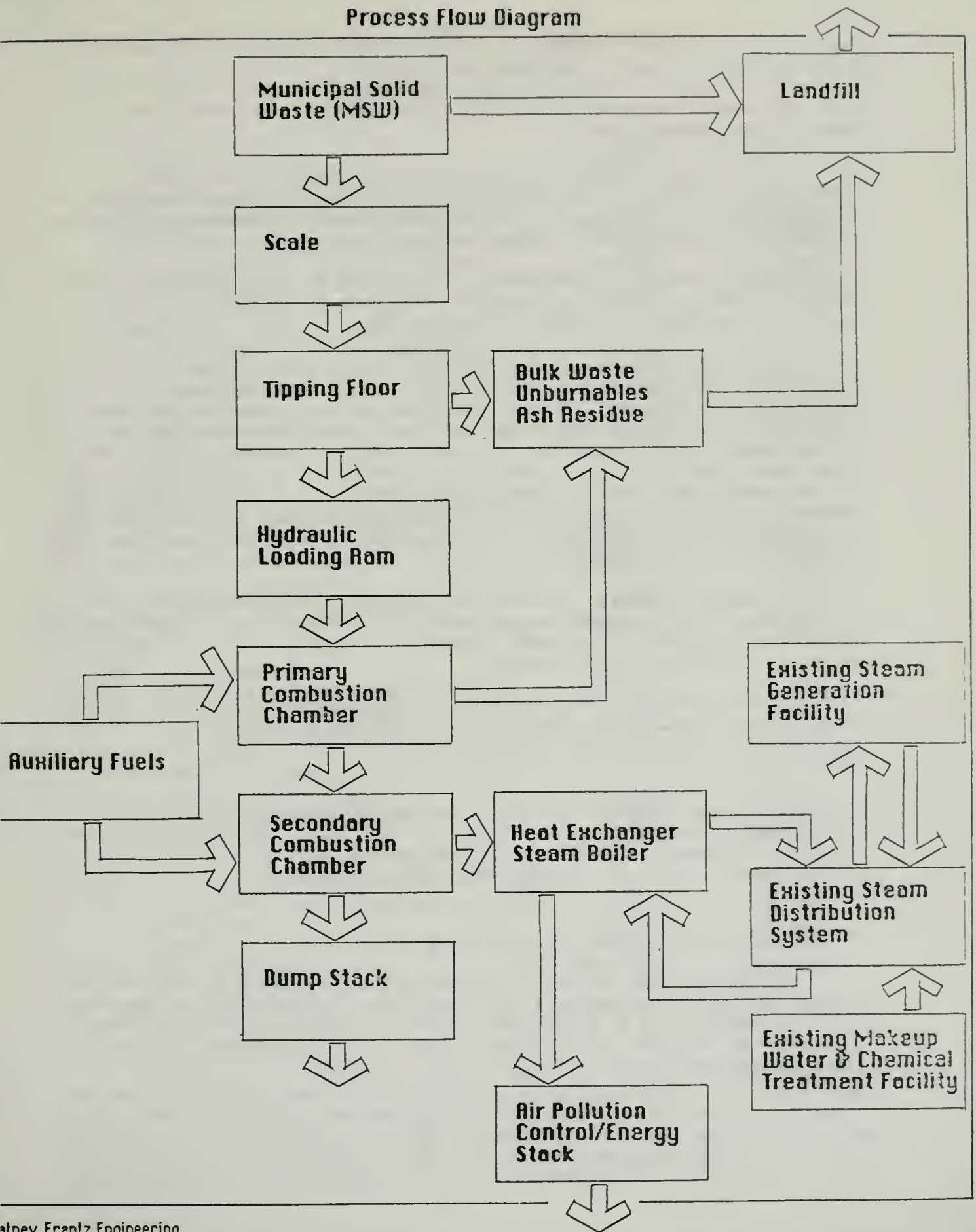
2. Ignition and primary combustion chamber: In this chamber of the incinerator chamber (starved air incinerator), auxiliary burners dry and ignite the entering waste. These burners operate on natural gas. They will be used to begin the combustion process, but once the combustion rate is sufficient to sustain itself the auxiliary fuel supply may be shut off.

A partial oxidation atmosphere is maintained in the primary combustion chamber by supplying less air than needed for complete combustion. Uncombusted gases and airborne particulates then rise into the secondary chamber for complete combustion. Those covered or unburned waste materials will be forced farther down into the incinerator as wastes are added to continue the burn. All unburned waste materials will eventually arrive at the lowest level of the primary chamber where they are removed with the ash.

3. Final burn in the secondary combustion chamber: like the primary chamber, the secondary chamber must use an auxiliary burner during the start-up phase. This burner ignites gases and particles flowing up from the lower primary chamber. Complete combustion will take place as the burning gases mix with the additional air added in this chamber.

Figure 5-4

Process Flow Diagram



Again, at a sufficient temperature this burning will become self sustaining and the auxiliary burners are shut off.

The secondary chamber is needed to complete the oxidation reactions begun in the primary chamber.

4. Controls: both chambers in the incinerator are monitored continually. Automatic controls will activate the auxiliary burners and introduce air as necessary. A control board signals an operator the current conditions throughout both chambers and the boiler.

The anti-pollution performance of this type of system depends on the control of the two combustion chambers. The primary chamber's air, gas velocities and temperature must be controlled.

The control of the secondary chamber is even more critical. Temperatures in the secondary chamber must be maintained between approximately 1,300 and 1,700 Fahrenheit; excess air should be kept above that amount required for combustion and for a proper retention time and mixing of all excess air and burning gases and particulates in the chamber. These conditions will nearly eliminate all combustion emissions but because of the heterogeneous nature of MSW and the difficulty in controlling the combustion of this type of waste fuel, it may be necessary to use additional air pollution control equipment. Further study is required to determine the need of such control equipment.

5. Heat exchanger: incinerator systems are connected to water or fire tube boilers to recover and exchange heat produced by the combustion in the secondary chamber. This heat produces the steam that will be delivered to the existing distribution system.

6. Ash removal: unburned waste materials are pushed automatically to lower levels as new MSW is added. The ash and unburned material will eventually be forced to exit the bottom of the primary chamber through a drop chute to a water pit. From there it will be taken to the landfill.

Waste materials that survive incineration are rendered relatively sterile and can be safely used for fill or road base. Daily coverage with soil may not always be necessary for such waste. Both ideas should be closely coordinated with the State Solid Waste Bureau.

Facility Cost and Construction Scheduling

The capital cost for the 32 ton/day facility, capable of handling all Madison and Beaverhead waste is estimated to be $1,953,000. This compares to the estimated cost of $1,334,000 for the 20 ton/day facility that would be capable of handling the reduced volumes of waste associated with the other options evaluated.

Table 5-2

MSW Recovery Facility
Estimated Capital Costs

	Facility Size 20 TPD	32 TPD
1. Incinerator/Boiler Cost		
a. Mass burn incinerator/boiler	$435,000	$725,000
b. Freight, handling and delivery cost	40,000	50,000
c. Installation and start-up fees	100,000	125,000
Sub total:	$575,000	$900,000
2. Necessary Accessories and Other Equipment Cost		
a. Water make-up system and deaerator	44,000	50,000
b. Economizer	17,000	19,000
c. Spare parts	6,000	7,000
d. Metering equipment	8,000	9,000
e. Other miscellaneous items	5,000	5,000
Sub total:	$80,000	$90,000
3. Associated Structure and Site Cost		
a. Building to house equipment and fuel	220,000	320,000
b. Scale and metering equipment	35,000	35,000
c. System connections	20,000	20,000
d. Utility connections	5,000	5,000
e. Necessary site improvements	15,000	15,000
Sub total:	$295,000	$395,000
4. Mobile Equipment Cost		
a. Small scale rubber-wheeled tractor(s)	20,000	35,000
b. Ash/white goods removal containers	15,000	30,000
Sub total:	$35,000	$65,000
5. Professional Cost		
a. Engineering services	118,000	175,000
b. Legal/Financial services	35,000	50,000
Sub total:	$153,000	$225,000
6. Contingency, Inflation and Interest Cost		
a. Contingency and miscellancy allowance	91,000	134,000
b. Inflation allowance	30,000	44,000
c. Construction loan interest	75,000	100,000
Sub total:	$196,000	$278,000
7. Total Project Cost:	$1,334,000	$1,953,000

In addition to the capital costs, annual facility operation costs were estimated. A breakdown of these annual costs are presented. As indicated in the table, the operation and maintenance costs were determined for any scenario by multiplying the tonnage of waste by a per ton cost and labor was assumed for this analysis to be the same for all possible solutions. Calculated per ton cost varied between approximately $22 and $36 per ton.

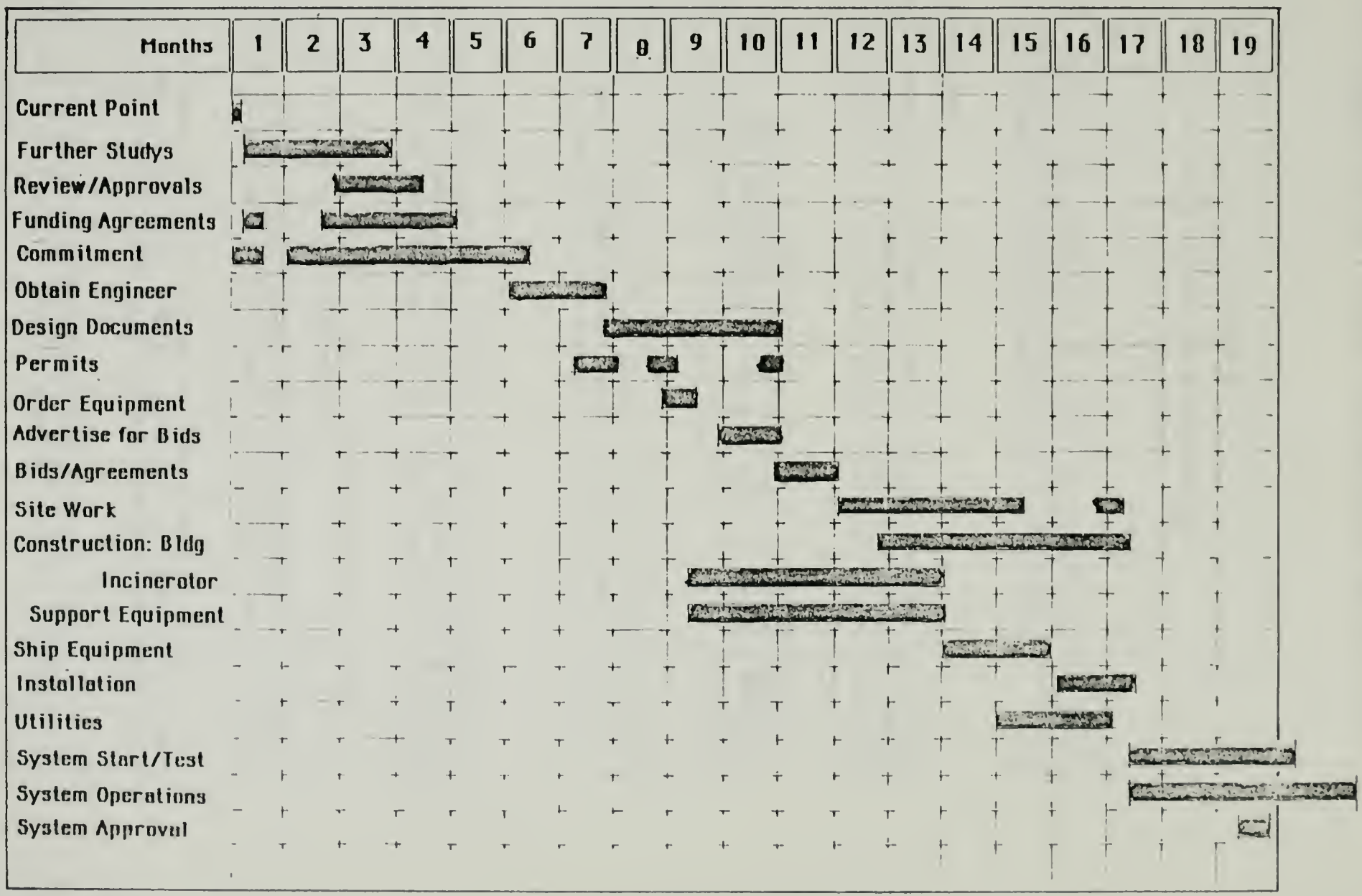
Table 5-3

MSW Recovery Facility
Estimated Annual Operating Cost

Item	$/Ton	Beaverhead	Beaverhead & West Madison
Electrical	$1.00	$4,578	$6,434
Water and Sewer	0.40	1,831	2,574
Natural Gas	1.20	5,494	7,721
Rolling Stock	1.20	5,494	7,721
Maintenance	4.00	18,312	25,739
Insurance	1.40	6,409	9,008
Ash Removal/Disposal	1.70	7,783	10,938
Labor Costs		110,000	110,000
Total Annual Cost:		$159,901	$180,135
Tons/Year Used:		4,477	6,231
Cost/Ton Calculated:		$35.72	$28.91

Typically, it can take up to two years to obtain financing for facilities of the type contemplated. The project is directly supported by both counties and Western Montana College, so perhaps this period would be reduced. A typical construction schedule of such a project is depicted on the following page.

Municipal Solid Waste Recovery Station
Proposed Implementation Timeline
Western Montana College, Dillon, Montana



Section Six

Legal Information and Agreements

Introduction

The purpose of this section is to review the agreements among the two counties and Western Montana College, and with any other parties. The laws governing the implementation of the facility also are discussed.

Coalition Agreements

Beyond committing money and/or time to prepare this report, no other commitments or agreements have been made. However, representatives of the coalition are particularly interested in seeing this project run its course to implementation.

The current "wait and see" attitude seems to have been generated by several factors. Western Montana College is properly in the controlling position; all is based on its need for steam. However, Western Montana College is currently without a president and has little means of committing to a long range project until a president takes office. This should take place in July of 1985.

The lack of a visible financial source or dramatic project savings has slowed the process. To speed progress, and for future planning, WMC and perhaps the state itself must make the project a priority.

Existing Issues

Some topics still are unresolved by the coalition. Included in the following text is a brief summary of some of the topics yet to be addressed or answered by the parties involved. Following each question is a tenative solution.

Question: Who will manage or own the recovery facility, land it is built on, landfills, containers, and trucks?

Answer: Western Montana College would own and operate the recovery facility. The landfill(s) and their responsibility would remain with the counties.

It is believed that rolling stock would be limited to vehicles necessary for moving MSW within the facility housing. If the ash removal is not contracted out, WMC would be responsible for its proper disposal and the equipment necessary to do so.

Question: Who will haul the trash and what will their full involvement and responsibilities be in the operation of the facility?

Answer: MSW from Madison County will be supplied by the county or an agent thereof. Unless Beaverhead County implements a program similar to that of Madison County, refuse received from Beaverhead will be delivered by private hauling firms. Again, this is assuming that all landfill sites but the current county landfill will be closed.

Question: How will individual taxpayers and cities and towns, in the study area be affected?

Answer: At this time no increase in assessments has been decided upon. This will depend on the coalitions' ability to arrange sufficient funding for the project.

Also, depending on the actions of Beaverhead County: assessment of individuals may be necessary to implement a container, or similar means, to transport the waste to Dillon. It is assumed that if the private hauler is charged with the responsibilty of transportation the recipients of the collection service will pay the bill.

Question: Who will pay for what?

Answer: All financial issues are unresolved at this time. For the purpose of this report it was assumed WMC would purchase and construct the facility. Possible sources of money are discussed in Section Seven of this report.

As noted above, a container program in Beaverhead County seems a possible off shoot of this project. If such is the case, assessments may be charged.

Question: Who will be responsible for providing the labor force to run the facility?

Answer: It has been assumed the WMC would be directly responsible for the labor necessary to maintain and operate the station. However, this does not include the transportation of waste to the facility. Transportation to the facility would be the responsiblity of private haulers and/or the counties.

Question: What agreements must be made and for how long?

Answer: Possible agreements related specifically to the project are as follows: those to guarantee MSW or wood for fixed fees, volume and term; any agreements regarding percentage of, and term for, the repayment of project costs. Several sample agreements that may serve as models for those to be used can be found at the end of this section.

Question: Are there any other ways to save money from this project?

Answer: Currently the county landfill in Beaverhead charges no tipping fees. The economics of imposing such a charge requires further investigation. The true savings via this project appear to be the avoided costs of ever-expanding landfill operations and the possible legal settlements because of their condition.

The implementation of a container/transfer program as a part of this project may prove economically sound and should be given further investigation. All savings obtained by Western Montana College eventually benefit the individual taxpayer.

Question: Who is responsible for the "next step," funding, site, construction, and operational decisions and how much public input will there be concerning these issues?

Answer: These issues must now be addressed by the coalition if the project is to move smoothly along. This coalition is responsible for dealing with all of these issues.

Question: Who will benefit?

Answer: In savings and avoided cost, it appears everyone involved will save. Agreements concerning the financial obligation of the coalition or any other parties are unresolved. If the project is profitable, Western Montana College will realize a savings through its reductions in operations and fuel cost. Madison County will realize a savings in transportation cost. Beaverhead County will realize a savings via the reduction of county landfill operations.

Relevant Requirements and Regulations

The legal requirements addressing the construction of the facility on the whole deal directly with two areas; the safety of any structure and its component systems, and the potential for environmental damages.

Building permits usually are not issued until the necessary environmental permits have been issued. This time period should allow ample time for the review and approval of the contract documents and specifications of the facility buildings.

The environmental permitting of the plant should be straightforward and problem free due to the relatively small size of the facility and the information available on such systems.

Plans for the project would be reviewed at the federal, state, county, and local levels. The following is a review of permits, laws, requirements, regulations, restraints and ordinances known to be relevant to the project.

The federal regulations which address projects of this type are contained in Public Law 94-580; the Resource Conservation and Recovery Act of 1976 (RCRA).

This law was set up to give state governments the power of enforcement, via the assistance of the Environmental Protection Agency. The State of Montana has standards which are identical to the federal standards in most cases.

Almost all of the state regulations addressing this project are within the jurisdiction of the Montana Department of Health and Environmental Sciences (DHES).

The three bureaus which have authority over the environmental aspects of this project are the Water Quality Bureau, the Air Quality Bureau, and the Solid Waste Bureau. All three bureaus have been contacted and no problems are foreseen. All appeared quite supportive of such a recovery facility.

The DHES has legal and administrative control over all phases of solid waste management, and holds the authority to deny or revoke a license to operate a solid waste management system.

The decision to deny or revoke a license may be made only after finding that a solid waste management system cannot or is not being operated within compliance of state law. The agency may address violation(s) by setting up a compliance schedule or initiate action to revoke licenses. The department may also enjoin the license holder or collect a criminal penalty.

Specific state level regulations of concern are:

Air Quality Permit: this permit is required prior to all construction and/or operational activities. It is issued by the Montana Department of Health and Environmental Sciences, Air Quality Bureau. This pertains to all sources which have the potential to emit more than 25 tons of any air contaminant per year. The present size and type of equipment being considered should fall well below this level, so this permit would not be required.

Prevention of Significant Deterioration of Air Quality Permit (PSD): this permit is required by the Department of Health and Environmental Sciences, Air Quality Bureau. It is required of all new facilities and modifications of facilities, if air emissions after the application of control equipment are more than 100 tons for 27 specifically listed industries and more than 250 tons for other industries after the application of control equipment. This permit is not applicable, due to the small size of this project.

License for Non-hazardous Solid Waste Management Systems: this license controls solid waste management systems in order to insure the proper and regulated disposal of solid waste. This license provides for the protection of the public's health and safety, and whenever possible conserves natural resources. This license will be necessary. It will be issued through the Department of Health and Environmental Sciences, Solid Waste Management Bureau, Capitol Station, Helena, Montana 59620. Telephone: (406) 444-2821.

Montana Antiquities Act Permit: this permit is applicable to any federal undertaking. A federal undertaking is defined as the issuance of any license, loan, grant, lease, permit, certification, or any specific ground or building disturbance, regardless of land ownership. This permit is also applicable to any state undertaking occurring on state-owned lands. This permit will be necessary. It will be issued through the Montana Historical Society, Capitol Station, Helena, Montana 59620. Telephone: (406) 444-7715.

State-Issued Mechanical and Plumbing Permit: the enforcement of these permits is applicable in areas not covered by a local government code enforcement program. These permits will be necessary. They will be issued through the Montana Department of Administration, Building Codes Division,

Capitol Station. Helena, Montana 59620. Telephone: (406) 444-3642.

State Issued Electrical Permits: same as above.

At this time, the project would not be affected by any known county requirement or regulation addressing air and water quality standards or sewage and waste disposal.

State law gives county commissioners the power to create solid waste districts for the purpose of collection and disposal of refuse. Cities and towns within the county may only be included in such a district by their choice and approval by the municipality's council. Creation of such districts might be useful to the proposed recovery facility and should be given further investigation.

No known requirement or regulation set by the City of Dillon or Western Montana College would prevent placement of the facility as proposed.

Nor is there any known city ordinance to address air and water quality standards or sewage and waste disposal. A city-issued Building Permit will be necessary. It will be issued through the City of Dillon, 125 North Idaho, Dillon, Montana 59725. Telephone: (406) 683 4245.

Municipal Solid Waste Recovery Station
Sample Coalition Agreement
Western Montana College, Dillon, Montana

This is an Agreement made as of this, the first day of May, in the year Nineteen Hundred Eighty-five.

By and between Western Montana College hereinafter referred to as the Owner, and Beaverhead County and Madison County of the State of Montana, and all other parties as agreed upon and having signed below hereinafter referred to as the Coalition.

Witnesseth:

Whereby, Western Montana College proposes to construct and operate a Municipal Solid Waste Recovery Station, hereinafter referred to as the Facility, on its campus in Dillon, Montana, for the purpose of reducing its annual energy costs.

Whereby, the projected operation cost of such a facility are substantial and the facility's operation is projected to reduce the operation costs of several Beaverhead and Madison County operations and/or those of other parties, and in order to operate the Facility and reduce the costs of current operations, of all parties, the Owner and Coalition do hereby enter into this contractual commitment, hereinafter referred to as the Agreement.

Now, Thereby, having entered into agreement, the parties agree as follows:

1. Contingent upon adequate funding being made available and appropriate governmental approval being obtained, Owner shall build the Facility capable of utilizing municipal solid waste as a fuel source. Owner and Coalition shall provide financial assistance in funding of the Facility as agreed upon and attached to this Agreement as an Exhibit or portion of one.

2. Owner and Coalition agrees to receive all combustible solid waste, or that amount as agreed upon and attached to this Agreement, from any parties of this Agreement or of those agreed upon and attached to this Agreement. Such solid wastes shall be received by the Facility at a location to be designated by the Owner. The delivery of said solid wastes shall begin as agreed upon by all parties and/or stated in other Agreements.

3. Owner and Coalition shall be jointly responsible for those operations necessary to properly maintain and operate the Facility. All parties shall be directly responsible for the services or financial assistance as agreed upon and attached to this Agreement.

4. Equipment necessary for the delivery, receival or removal of the solid waste shall remain the responsibility and property as agreed upon. All equipment, materials and components of the Facility shall be listed and attached to this Agreement; said list shall assign party of responsiblity and party of ownership.

5. No one party, or number of parties, shall be allow to obligate the Owner or any other member of the Coalition without the consent of all signing parties. Said party obligating otherparties without their consent shall be soley responsible for all liabilities incurred.

6. The Owner shall be solely responsible for the proper maintenance of the site and surrounding porperty of the Facility. Said Facility shall be the sole property of the Owner.

7. Coalition Facility users shall pay any "tipping fees" that shall be charged. It is agreed that said fees shall not be charged at this time. Tipping fees to be charged shall be agreed upon by all parties; that amount attached to this Agreement as an Exhibit or portion of one. Said fees shall be billed monthly.

8. The Owner reserves the right to reject any and all solid waste received, if, in the Owner's opinion, it is not suitable as combustible material, or presents a material risk or hazard to persons, the environment, or the Facility, or do to size constraints the waste or portions of the waste are unusable.

9. The time period of which the Agreement shall be in full force and effect will be from the above first recorded date through the tenth anniversary, in years, of that date. All parties may renegotiation this Agreement or any portions herein, agreed upon changes shall be attached to this Agreement as an Exhibit or portion of one; signed by all parties and dated.

Municipal Solid Waste Recovery Station
Sample Agreement Between Facility User & Owner
Western Montana College, Dillon, Montana

This is an Agreement made as of this, the first day of May, in the year Nineteen Hundred Eighty-five.

By and between Western Montana College hereinafter referred to as the Owner, and _____ hereinafter referred to as the Facility User.

Witnesseth:

Whereby, Western Montana College proposes to construct and operate a Municipal Solid Waste Recovery Station, hereinafter referred to as the Facility, on its campus in Dillon, Montana, for the purpose of reducing its annual energy costs.

Whereby, the projected operations of such a facility are substantial and the facility's feasibility is dependent on a continuous supply of combustible solid waste, and in order to assure such a supply of combustible solid waste is delivered is a safe and proper manner the Owner and Facility User do hereby enter into this contractual commitment, hereinafter referred to as the Agreement.

Now, Thereby, having entered into agreement, the parties agree as follows:

1. Contingent upon adequate funding being made available and appropriate governmental approval being obtained, Owner shall build the Facility capable of utilizing municipal solid waste as a fuel source.

2. Facility User agrees to deliver all combustible solid waste in a safe, contained manner. Said user hereby agrees to adhere to the guidelines for the proper transportation of trash and waste; attached to this Agreement as an Exhibit or portion of one. The Owner shall maintain the right to turn away any deliveries arriving which do not comply with the attached guidelines.

3. Owner and Facility User shall be aware of, and comply with, all city requirements addressing solid waste, trash and litter. Owner shall be responsible for the proper storage, removal and disposal of ash and unused waste materials located at the Facility.

4. The delivery of wastes materials shall not be receive by the Owner before or after those Facility delivery hours as posted at the site of the Facility, or as attached. The Owner may close the Facility to receiving waste materials at any time.

5. All dumping of combustible or non-combustible solid wastes, exterior of the Facility's "Tippping Floor," during times other then those posted, or against employee directions shall be illegal. Facility User shall be reponsible for damages, legal, and clean up cost of Owner. Owner shall maintain the right to use legal action to correct Owner/Faciltiy User problems; said user being directly responsible for all Owner legal expenses.

6. Facility User shall be solely responsible for the operations necessary to deliver the solid waste to the Owner. The equipment necessary for the delivery of the solid waste shall remain the responsibility and property of the Facility User.

7. All combustible and non-combustible solid wastes deliveried to the Facility shall become the property of the Owner upon their dumping or unloading, legally or illegally. Facility User shall surrender all rights to deliveried waste material. Owner may use materials in any manner he sees fit.

8. The Owner shall be solely responsible for the operations of the Facility. Said Facility shall be the sole property of the Owner.

9: The Facility User shall pay the Owner any "tipping fees" he shall charge. It is agreed that said fees shall not be charged at this time. Tipping fees to be charged shall be solely the decision of Owner; that amount attached to this Agreement as an Exhibit or portion of one. Said fees shall be paid by the Facility User at each visit to the Facility. Owner shall provide notice of an increase in charges no less then 30 days before increases take effect.

10. The Owner reserves the right to reject any and all solid waste received, if, in the Owner's opinion, it is not suitable as combustible material, or presents a material risk or hazard to persons, the environment, or the Facility, or do to size constraints the waste or portions of the waste are unusable.

11. The time period of which the Agreement shall be in full force and effect will be from the above first recorded date through the first anniversary, in years, of that date. Both parties may renegotiation this Agreement or any portions herein, agreed upon changes shall be attached to this Agreement as an Exhibit or portion of one; signed by both parties and dated.

Municipal Solid Waste Recovery Station
Sample Agreement to Provide Facility With Usable Waste
Western Montana College, Dillon, Montana

This is an Agreement made as of this, the first day of May, in the year Nineteen Hundred Eighty-five.

By and between Western Montana College hereinafter referred to as the Owner, and _____ hereinafter referred to as the Contractor.

Witnesseth:

Whereby, Western Montana College proposes to construct and operate a Municipal Solid Waste Recovery Station, hereinafter referred to as the Facility, on its campus in Dillon, Montana, for the purpose of reducing its annual energy costs.

Whereby, the projected cost of such a facility are substantial and the facility's feasibility is dependent on a continuous supply of combustible solid waste, and in order to assure such a supply of combustible solid waste the Owner and Contractor do hereby enter into this contractual commitment, hereinafter referred to as the Agreement.

Now, Thereby, having entered into agreement, the parties agree as follows:

1. Contingent upon adequate funding being made available and appropriate governmental approval being obtained, the Owner shall build the Facility, it being capable of utilizing municipal solid waste as a fuel source.

2. Contractor agrees to deliver all of his combustible solid waste, or that amount as agreed upon and attached to this Agreement as an Exhibit or portion of one, to Owner at a location to be designated by the Owner. The delivery of said solid wastes shall begin, by the Contractor, upon written notification by the Owner, such notification shall be received by the Contractor within 90 days of the completion of the Facility and its supporting equipment systems. Delivery of said solid wastes shall begin no later than 30 days of written notification.

3. Contractor shall be solely responsible for the operations necessary to deliver the solid waste to the Owner. The equipment necessary for the delivery of the solid waste shall remain the responsibility and property of the Contractor.

4. The Owner shall be solely responsible for the operations of the Facility. Said Facility shall be the sole property of the Owner.

5. The Contractor shall pay the Owner any "tipping fees" he shall charge. It is agreed that said fees shall not be charged at this time. Tipping fees to be charged Contractor shall be agreed upon by both parties; that amount attached to this Agreement as an Exhibit or portion of one. Said fees shall be billed monthly. Owner shall provide notice of an increase in charges no less then 30 days before increases take effect.

6. The Owner reserves the right to reject any and all solid waste received, if, in the Owner's opinion, it is not suitable as combustible material, or presents a material risk or hazard to persons, the environment, or the Facility, or do to size constraints the waste or portions of the waste are unusable.

7. The time period of which the Agreement shall be in full force and effect will be from the above first recorded date through the fifth anniversary, in years, of that date. Both parties may renegotiation this Agreement or any portions herein, agreed upon changes shall be attached to this Agreement as an Exhibit or portion of one; signed by both parties and dated.

Section Seven

Financial Support

Introduction

The following text is a brief overview of the current financing situations of the counties and Western Montana College and several possible alternative sources of funding for the construction of the MSW recovery facility.

Current Situation

The method currently used to offset operation costs for the county landfills (and the container program in Madison County) is to assess a fee from each household. This is used to help maintain the county landfill but does not support collection costs assessed by private collectors.

Under current financial policy of the Montana University System, WMC pays the utility fees for the dormitories. Utilities for the classroom facilities are paid for by the university system's general fund. At WMC the dormitories are responsible for approximately 40% of campus heating consumption. This means, if the project is financed with funds designated for Western Montana College or a combination which included other local funds, WMC would receive only 40% of the benefit in savings which it was directly responsible for producing. The other 60%, an amount equal to the savings in fuels cost of the classroom facilities would simply no longer be designated to WMC from the general fund.

The financial viability of this project will likely pivot on the ability to modify policy and allow WMC to keep the savings generated. One possible scenario for overcoming this problem is being written by Glen D. Leavitt, Fiscal Affairs Director, Western Montana College, and will be attached as an appendix upon its completion (Appendix C).

Economic Development Administration (EDA)

The Business Loan Division of the EDA will allocate grants to municipalities and cities, for projects such as the proposed MSW recovery facility.

Department of Natural Resources and Conservation (DNRC)

A Renewable Energy program has been established by the Montana Department of Natural Resources and Conservation to reduce the state's reliance on fossil fuels through the increased use of alternative fuels such as biomass which includes MSW. Grants and loans are funded through Montana's Coal Severance Tax Program. The loan program includes commercial ventures and projects which have an income-generating potential, whereas the grant program is essentially restricted to research, development and demonstrative projects.

Some of the funding for the preparation of this report was under Contract Agreement No. ED-WMC-740 with the Biomass Utilization and Cogeneration Program of the DNRC. The maximum loan amount in fiscal year 1984 was limited to $333,600 to a single borrower. Repayment is regulated within a 10-year period.

Department of Health and Environmental Sciences (DHES)

The DHES may provide financial assistance to local governments for front-end planning activities for proposed solid waste management systems that are compatible with the state plan whenever such financial assistance is available. This department may also provide front-end organizational loans for the implementation of an approved solid waste management system with the availability of funds.

Conventional Bank Loan Financing

Conventional bank loans are another possible funding source. The money would probably be borrowed against the value of the facility and the credit of the owner. Assuming that Western Montana College is responsible for the facility, the State of Montana would be the owner. For the purpose of most calculations, conventional loans at 12% interest, over 20 years, were assumed.

Industrial Revenue Bonds

Revenue bonds would be secured only by the project revenues and the credit of the owner, with repayment strictly from the revenues generated by the project. Bonds of this nature can be issued for periods of up to 30 years, but shorter terms are usually preferred to ensure acceptance in the bond market. Several types of bonds issued under state and local government are as follows:

Pollution Control Revenue Bonds: these bonds are available for the financing of installation of equipment designed to control or nullify pollution. At the present there is no ceiling on the number of bonds that may be issued for this purpose.

Solid Waste Disposal Bonds: these bonds may be issued to finance solid waste disposal facilities, under which definition, such as the proposed project. This financing option is pertinent only if MSW is incinerated. However, the bond may not be available if the MSW is considered to have a value. The project also would not be eligible for tax exemption if the MSW to be incinerated has value, according to the IRS.

The IRS does not consider wood residue a solid waste disposal problem, rendering serious consideration to the aspect of burning wood residues as a supplemental fuels source.

Economic Development Revenue Bonds: these bonds are available for the stimulation of a depressed economy through the creation of jobs and the increase of the tax base. The proposed facility must be located in the depressed area it is intended to help.

Third-Party Financing

Third-party financing for energy generation and conservation projects is available from a number of private investment firms. One such group, Pacific Energy Group of Idaho and Alaska, has in the past negotiated with Mount Ellis Academy, a Seventh Day Adventist High School in Bozeman, Montana to install a cogeneration plant near the school campus.

Jeff Hampton of Pacific Energy Group was contacted to investigate the possibility of third party financing for the MSW recovery facility at Western Montana College. Preliminary results were expected before this report's completion. After numberous attempts to contact Pacific Energy Group, it is believed that the firm is no longer doing business.

Research Resources Incorporated of Utah has been negotiating with the City of Livingston (Montana). The city was contacted to monitor their contract negotiations with the firm. The project is to produce an average of 12.5 megawatts for sale, consuming approximately 95,000 tons of wood waste annually.

The city never entered into an agreement with Research Resources Incorporated. Attempts were made to contact Research Resources Incorporated but it appears that this firm is no longer doing business.

Another third party financier was contacted, Energy Management Consultant Engineers, Incorporated (EMC) of Colorado (303) 988-3951. Carl Svard of EMC indicated his firm would be interested in financing the project if the simple payback was less than three years.

In talking with financiers, it was determined that third party financing is not a realistic option due to the length of the simple payback periods projected at this time. The best case scenerio of this report (assuming no government grants) has a simple payback of approximately 6.9 years ($1,334,000/$192,497).

Tax Incentives

The United States Congress has created legislation allowing tax incentives for alternative energy systems in the Energy Tax Act of 1978. These incentives were then expanded and modified in the Crude Oil Windfall Profit Tax Act of 1980. New tax incentives for all types of investments were enacted by the US Congress in the Economic Recovery Tax Act of 1981.

Three major tax incentives are in effect for cogeneration projects:

1. Regular Investment Tax Credit
2. Energy Investment Tax Credit
3. Economic Recovery Tax Act

The regular investment tax credit also is applicable to the investment cost for all components of the recovery station and equipment. The building costs would not apply under this credit however. The current rate of this tax credit is set at 10% of cost of qualified investments.

Under the Energy Investment Tax Credit provision, legislation allows for an additional 10% tax credit through 1985 for biomass equipment. Biomass equipment is defined as follows:

> "...a boiler or burner that utilizes fuel sources other than oil, gas or coal, or products thereof, as more than half its fuel."

This credit covers all the associated fuel-handling and pollution-control equipment for a qualifying system.

According to the Economic Recovery Tax Act of 1981, a new Accelerated Cost Recovery System (ACRS) was established whereby qualifying equipment should be within the criteria for the accelerated cost recovery system and allowed to be depreciated within five years. Most buildings could be depreciated in 15 years, independent of their physical lives governed under the pre-existing ITC Section 167 rules for Asset Depreciation Ranges (ADR) but the depreciation has to be reduced by one-half the tax credit taken, both can not be taken at the same time (1984 Tax Act). The municipal solid waste recovery station should qualify for the ACRS and therefore a five year depreciation schedule should be as follows: 15, 22, 21, 21, 21 percents.

Section Eight

Computer Simulation

Introduction

This section is to explain the computer simulation used to address the major economic variables involved in the proposed project. The simulation is an up-graded version of the one presented in the 1982 report (Preliminary Feasibility Study: Municipal Solid Waste to Steam Conversion at Dillon, Montana, Matney Frantz Engineering, June 1982).

Computer Simulations Presented

Seven simulation scenarios have been provided at the end of this section, they are:

1. Existing Situation: this is the base simulation to show existing conditions and those assumptions made.

2. Only Beaverhead County Municipal Solid Waste: this simulation projects the financial results if only the MSW of Beaverhead County was used to operate the facility. This scenario predicts a savings only during the month of May and an annual loss of $25,524.00.

3. Both Beaverhead and Madison County Municipal Solid Waste: this scenario uses MSW from both counties. Though the printout shows a savings for the months of January, March, April, and October through December, it predicts an annual loss of $25,106.00.

4. Both Beaverhead and the Western Portion of Madison County Municipal Solid Waste: this proved the most favorable scenario investigated. Using the MSW from all of Beaverhead and only the western portion of Madison County, the simulation predicted a savings in every month but July and August. This results in an estimated annual savings of $13,897.00.

5. Both Beaverhead and the Western Portion of Madison County With a $100,000 Grant: the scenario used here is the same as #4 above, but with a $100,000 grant applied to the debt service. $27,297.00 is the predicted annual savings with such a grant.

6. Both Beaverhead and the Western Portion of Madison County With a $500,000 Grant: again, this scenario is the same as #4, however, it assumes a grant of $500,000. The estimated savings per year is $80,797.00.

7. Both Beaverhead and the Western Portion of Madison County With a Full Cost of Construction Grant ($1,500,000): since it is possible that the state could fund the entire project, such a scenario was used with the most feasible MSW scenario. The simulation predicted an estimated annual savings of $192,497.00.

Explantion of Simulation

The following is a brief explanation of each of the columns labeled on the printout. The actual calculations done by the simulation are shown in an appendix of this report.

Though developed for this project, by entering the appropriate inout vectors this simulation should be capable of addressing other projects and their economic feasibility.

Each printout begins with its input vectors; they are:

1. Monthly Natural Gas: this column is made up of the historical natural gas consumption of Western Montana College. These figures are in MCF/Month and must be presented for each month of the year.

2. Total Available Solid Waste: this figure is the total of all MSW available within the study area. Units are Tons/Year.

3. Total Solid Waste to be Used: this is the amount of MSW available under the scenario being used; this will be all of the refuse delivered to the recovery facility. Units are Tons/Year.

4. Current Cost of a MCF: this is the current cost of a MCF of natural gas as purchased from the supplier. This figure is in Dollars/MCF.

5. Solid Waste Removal: this is the current cost to WMC for disposal of the refuse it generates. Units are Dollars/Year.

6. Estimated Annual Cost of Natural Gas: this is the estimated cost of natural gas that will be used by the proposed project. Units are Dollars/Tons of MSW.

7. Estimated Annual Cost of Dumping Ash: this is the estimated cost of removing the ash and other unburnables from the proposed project to the landfill. Units are Dollars/Tons of MSW.

8. Estimated Annual Cost of Additional Electricity: this is the estimated cost of the electricity that will be used by the prooosed project. Units are Dollars/Tons of MSW.

9. Estimated Annual Cost of Parts and Supplies: this is the estimated cost to keep the proposed facility running by replacing worn or damaged parts. Units are Dollars/Tons of MSW.

The second page of the input vectors consists of:

10. Solid Waste Removal: this is WMC's cost to remove the waste generated on campus after the proposed project is implemented. Units are in Dollars/Year.

11. Current Cost of Labor of Heating Plant: this is the estimated cost to WMC to pay salaries for operating the existing heating plant and its related operations. Units are in Dollars/Year.

12. Current Cost to Operate of Beaverhead County Landfill: this figure is the estimated cost Beaverhead County pays to maintain its existing landfill operations. Units are in Dollars/Year.

13. Current Cost to Operate of Madison County Landfill: this figure is the estimated cost Madison County pays to maintain its existing landfill operations. Units are in Dollars/Year.

14. Estimated Annual Debt Service: this figure is the estimated service that will be paid each year in repayment of the money used to finance the construction of the proposed project. Units are in Dollars/Year.

15. Estimated Wood Waste: this is the estimated available wood waste that could be contracted for delivery from local lumber mills. The units are in Tons/Year.

16. Estimated Annual Cost of Other Expenses: this is the estimated cost that the proposed project will have to pay in miscellaneous expenses. Units are in Dollars/Tons of MSW.

17. Estimated Annual Cost of Labor: this figure is the estimated cost to pay the salaries to run the proposed project. Units are in Dollars/Year.

18. Cost to Operate Beaverhead County Landfill: this is the estimated cost to operate the county landfill if the proposed project is implemented. Units are in Dollars/Year.

19. Cost to Operate Madison County Landfill: this is the estimated cost to operate the county landfill if the proposed project was implemented. Units are in Dollars/Year.

20. Total Tipping Fees: this is the estimated fee that will be received by the proposed project by charging people to use the facility. Units are in Dollars/Year.

21. Cost of Wood Waste: this is the estimated cost per unit of wood waste for which the recovery station could have short term contracts for winter delivery. Units are in Dollars/Year.

Following the two pages of input vectors is the simulation printout. Each page contains six columns. At the top of each column is the title of the entity addressed in that column and a short heading to label the column. In order they are:

1. Month of Year: the rows of each column are labeled for each month, and the total for a year and an average over a year.

2. Natural Gas Usage: this is the average month's historical natural gas consumption divided by the number of days in the month. The figures are derived from WMC's historical energy data and are in MCF per day.

3. Required Energy: this is the average MMBtus of natural gas required per day of the month to heat the WMC campus. The figures are MMBtu/Day. There are 873,171 Btus per MCF in the Dillon area.

4. Required Solid Waste: this is the amount of MSW that is required to meet the MMBtu demand of Western Montana College. The figures are shown in Tons/Day.

5. Available Solid Waste: this is the total amount of MSW available in the study area. These figures are directly based on input vector number 2. Units are in Tons of MSW/Day.

6. Solid Waste Used: this is the portion of the total amount of MSW available that will be used in the scenario being considered. The figures are directly related to input vector number 3 and are in Tons of MSW/Day.

The second page of the simulation printout consists of:

7. Required Wood: this is the estimated amount of wood waste that would be required to make up the difference between the needed and available amounts of solid waste material. The units are Tons of Wood Waste/Day.

8. Required Natural Gas: these figures are the required amount of natural gas for incineration start-up and make-up gas due to the difference in the available energy in the MSW and the needed energy to heat WMC. The units are MCF of natural gas/Month.

9. Natural Gas Cost Without Project: this is the estimated cost of the natural gas used by Western Montana College to heat campus. This is the cost before the proposed project is implemented and is in Dollars/Month.

10. Solid Waste Removal Cost: the cost of removing the garbage and waste that is generated on the campus of Western Montana College. This cost is before implementation of the proposed project and the figures are in Dollars/Month.

11. Landfill Operations Cost: as labeled on the printout, these figures are for the operation of the Beaverhead Landfill; the cost is before the implementation of the proposed project. Units are in Dollars/Month.

12. Landfill Operations Cost: the cost of landfill operations in Madison County before implementing the proposed project. The units are in Dollars/Month. Both this column and column 11 are directly related to input vectors.

The third page of the simulation printout consists of:

13. Natural Gas Cost: this is the cost of the natural gas that will be used in the operation of the proposed facility. The figures are in Dollars/Month.

14. Solid Waste Removal Cost: the cost of removing the garbage and waste that is generated on the campus of Western Montana College. This cost is after implementation of the proposed facility and the figures are in Dollars/Month.

15. Dumping Solid Waste Fees: this is the cost currently being charged by Beaverhead County Landfill to dump solid waste at the landfill. The tipping fee is in Dollars/Month income.

16. Dumping Ash: This is the cost to remove the ash and unburnable waste from the proposed facility to the landfill. It is related to an input vector and the tons of MSW burned.

17. Labor/Operation Cost: the estimated cost of labor and operations for heating Western Montana College without the proposed project. Units are Dollars/Month.

18. Labor/Operation Cost: this is the cost of labor and operations to use the proposed facility. The units are Dollars/Month.

The fourth page of the simulation consists of:

19. Additional Electricity: this is the cost of additional electricity that would be required by the proposed project in dollars. These figures are in Dollars/Month.

20. Parts and Supplies: the cost of parts and supplies necessary to the operation of the proposed facility. As can be noted in the column headings, the operation costs of the proposed facility are assumed to be paid by the coalition. These figures are in Dollars/Month.

21. Other Annual Costs: the cost to the coalition of other annual miscellaneous expenses necessary to the operations of the proposed facility. Units are Dollars/Month.

22. Landfill Operations with Project: the cost to Beaverhead County for landfill operations after the proposed project has been implemented.

23. Landfill Operations with Project: the cost to Madison County for landfill operations after the proposed project has been implemented.

24. Debt Services: this is the cost of repayment of the loans necessary to construct the proposed facility. The figures are in Dollars/Month.

The fifth page of the simulation printout consists of:

25. Total Cost Without Project, Western Montana College: this is the current cost to heat Western Montana College and to remove debris generated from the college.

26. Total Cost With Project, Western Montana College: this is what WMC would pay to heat campus if the proposed facility was implemented. Units for both columns 25 and 26 are in Dollars/Month.

27. Total Saved With Project, Western Montana College: the total amount to be saved or lost by Western Montana College as a result of the project. The figure is simply column 25 minus column 26. If there is a negative number (a loss), the number appears in parentheses. Units are in Dollars/Month.

28. Total Cost Without Project, Beaverhead County: this is the total cost of landfill operations for Beaverhead County.

29. Total Cost With Project, Beaverhead County: the total cost of landfill operations for Beaverhead County after the implementation of the project. Both columns 28 and 29 are in units of Dollars/Month.

30. Total Saved With Project, Beaverhead County: the total amount saved or lost by Beaverhead County as a result of the project. The figure is simply column 28 minus column 29. If there is a negative number (a loss), the number appears in parentheses. Units are in Dollars/Month.

The final page of the simulation printout consists of:

31. Total Cost Without Project, Madison County: the total cost of landfill operations to Madison County without the project.

32. Total Cost With Project, Madison County: the total cost of landfill operations to Madison County after the implementation of the proposed project. Both columns 31 and 32 are in units of Dollars/Month.

33. Total Amount Saved, Madison County: the total amount saved or lost by Madison County as a result of the project. The figure is simply column 31 minus 32. If there is a negative number (a loss), the number appears in parentheses. The units are Dollars/Month.

34. Total Cost Without Project, Coalition: this is the total cost to heat WMC and operate the Madison and Beaverhead landfills before project implementation.

35. Total Cost With Project, Coalition: this is the total cost to the coalition to heat WMC and operate the Madison and Beaverhead landfills after the implementation of the proposed facility. Both columns 34 and 35 are in Dollars/Month.

36. Total Project Savings, Coalition: this is the total amount saved or lost as a result of the project's implementation. If the dollar figure indicates a loss, it is shown in parentheses. Units are Dollars/Month.

Computer Simulation: Condition; Existing Situation

Input Vectors:

	Monthly Natural Gas Usage (Historical) in MCF per Month	Total Available Solid Waste in Tons per Year	Total Solid Waste to be Used in Tons per Year	Current Cost of a MCF of Natural Gas in Dollars per MCF	Solid Waste Removal From Campus of WMC in Dollars per Year
January	8340	8084	0	4.481	2712
February	7300				
March	6170	Estimated Annual Cost of Natural Gas Usage in Dollars per MSW Ton	Estimated Annual Cost of Dumping of Ash in Dollars per MSW Ton	Estimated Annual Cost of Electricity in Dollars per MSW Ton	Estimated Annual Cost of Parts & Supplies in Dollars per MSW Ton
April	5180				
May	3100				
June	2270				
July	1250	0.00	0.00	0.00	0.00
August	1600				
September	2440				
October	3480				
November	6280				
December	8120				

Computer Simulation: Condition; Existing Situation

Solid Waste Removal From Campus After Project: $/Year	Current Cost of Labor to Operate Existing Facility: $/Year	Current Cost to Operate Beaverhead County Landfill: $/Year	Current Cost to Operate Madison County Landfill: $/Yr	Estimated Annual Debt Service for Project in Dollars per Year	Total Available Wood Waste in Tons per Year
2712	140000	104880	134500	0	8000

Estimated Annual Cost of Other Expenses in Dollars per MSW Ton	Estimated Cost of Labor to Operate New/Both Facilities: $/Year	Cost to Operate Beaverhead Landfill After Project: $/Year	Cost to Operate Madison County Landfill After the Project: $/Year	Total Tipping Fees to be Collected With This Project: $/Year	Estimated Cost of Wood Waste in Dollars per Ton
0	140000	104880	134500	0	0.00

Computer Simulation: Condition; Existing Situation

Month of Year	Western Montana Natural Gas Usage Average Over Month MCF/Day	Western Montana Required Energy Average Over Month MMBtu/Day	Western Montana Required Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Available Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Solid Waste Used Average Over Month Tons/Day
January	269.0	234.9	50.52	16.43	0.00
February	258.4	225.6	48.52	15.02	0.00
March	199.0	173.8	37.37	17.60	0.00
April	172.7	150.8	32.42	22.37	0.00
May	100.0	87.3	18.78	39.12	0.00
June	75.7	66.1	14.21	26.00	0.00
July	40.3	35.2	7.57	25.69	0.00
August	51.6	45.1	9.69	24.64	0.00
September	81.3	71.0	15.27	19.81	0.00
October	112.3	98.0	21.08	20.08	0.00
November	209.3	182.8	39.31	20.34	0.00
December	261.9	228.7	49.19	17.86	0.00
Total	1831.6	1599.3	343.94	264.96	0.00
Average	152.6	133.3	28.66	22.08	0.00

Computer Simulation: Condition; Existing Situation

Beaverhead/Madison Required Wood to Make up Difference	Western Montana Required Natural Gas Start up/Make up	Western Montana Natural Gas Cost Without Project	Western Montana Solid Waste Removal Cost Without Project	Beaverhead County Landfill Operations Cost Without Project	Madison County Landfill Operations Cost Without Project
Tons/Day	MCF/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
28.07	8340.0	$37371.54	$226.00	$8740.00	$11208.33
26.96	7300.0	$32711.30	$226.00	$8740.00	$11208.33
20.76	6170.0	$27647.77	$226.00	$8740.00	$11208.33
18.01	5180.0	$23211.58	$226.00	$8740.00	$11208.33
10.43	3100.0	$13891.10	$226.00	$8740.00	$11208.33
7.89	2270.0	$10171.87	$226.00	$8740.00	$11208.33
4.21	1250.0	$5601.25	$226.00	$8740.00	$11208.33
5.38	1600.0	$7169.60	$226.00	$8740.00	$11208.33
8.48	2440.0	$10933.64	$226.00	$8740.00	$11208.33
11.71	3480.0	$15593.88	$226.00	$8740.00	$11208.33
21.84	6280.0	$28140.68	$226.00	$8740.00	$11208.33
27.33	8120.0	$36385.72	$226.00	$8740.00	$11208.33
191.08	55530.0	$248829.93	$2712.00	$104880.00	$134500.00
15.92	4627.5	$20735.83	$226.00	$8740.00	$11208.33

Computer Simulation: Condition; Existing Situation

Coalition Natural Gas Cost With Project	Western Montana Solid Waste Removal Cost With Project	Beaverhead County Dumping Solid Waste Tipping Fees	Coalition Dumping Ash All Cost Necessary	Western Montana Labor/Operation Cost Without Project	Coalition Labor/Operation Cost With Project
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$37371.54	$226.00	$0.00	$0.00	$11666.67	$11666.67
$32711.30	$226.00	$0.00	$0.00	$11666.67	$11666.67
$27647.77	$226.00	$0.00	$0.00	$11666.67	$11666.67
$23211.58	$226.00	$0.00	$0.00	$11666.67	$11666.67
$13891.10	$226.00	$0.00	$0.00	$11666.67	$11666.67
$10171.87	$226.00	$0.00	$0.00	$11666.67	$11666.67
$5601.25	$226.00	$0.00	$0.00	$11666.67	$11666.67
$7169.60	$226.00	$0.00	$0.00	$11666.67	$11666.67
$10933.64	$226.00	$0.00	$0.00	$11666.67	$11666.67
$15593.88	$226.00	$0.00	$0.00	$11666.67	$11666.67
$28140.68	$226.00	$0.00	$0.00	$11666.67	$11666.67
$36385.72	$226.00	$0.00	$0.00	$11666.67	$11666.67
$248829.93	$2712.00	$0.00	$0.00	$140000.00	$140000.00
$20735.83	$226.00	$0.00	$0.00	$11666.67	$11666.67

Computer Simulation: Condition; Existing Situation

Coalition Additional Electricity Cost With Project	Coalition Parts and Supplies Cost With Project	Coalition Other Annual Cost With Project	Beaverhead County Landfill Operations With Project	Madison County Landfill Operations With Project	Coalition Debt Services Average Over Year
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00
$0.00	$0.00	$0.00	$104880.00	$134500.00	$0.00
$0.00	$0.00	$0.00	$8740.00	$11208.33	$0.00

Computer Simulation: Condition; Existing Situation

Western Montana Total Cost Without Project Dollars/Month	Western Montana Total Cost With Project Dollars/Month	Western Montana Total Amount Saved With Project Dollars/Month	Beaverhead County Total Cost Without Project Dollars/Month	Beaverhead County Total Cost With Project Dollars/Month	Beaverhead County Total Amount Saved With Project Dollars/Month
$49264.21	$49264.21	$0.00	$8740.00	$8740.00	$0.00
$44603.97	$44603.97	$0.00	$8740.00	$8740.00	$0.00
$39540.44	$39540.44	$0.00	$8740.00	$8740.00	$0.00
$35104.25	$35104.25	$0.00	$8740.00	$8740.00	$0.00
$25783.77	$25783.77	$0.00	$8740.00	$8740.00	$0.00
$22064.54	$22064.54	$0.00	$8740.00	$8740.00	$0.00
$17493.92	$17493.92	$0.00	$8740.00	$8740.00	$0.00
$19062.27	$19062.27	$0.00	$8740.00	$8740.00	$0.00
$22826.31	$22826.31	$0.00	$8740.00	$8740.00	$0.00
$27486.55	$27486.55	$0.00	$8740.00	$8740.00	$0.00
$40033.35	$40033.35	$0.00	$8740.00	$8740.00	$0.00
$48278.39	$48278.39	$0.00	$8740.00	$8740.00	$0.00
$391541.93	$391541.93	$0.00	$104880.00	$104880.00	$0.00
$32628.49	$32628.49	$0.00	$8740.00	$8740.00	$0.00

Computer Simulation: Condition; Existing Situation

Madison County Total Cost Without Project Dollars/Month	Madison County Total Cost With Project Dollars/Month	Madison County Total Amount Saved With Project Dollars/Month	Coalition Total Cost Without Project Dollars/Month	Coalition Total Cost With Project Dollars/Month	Coalition Total Amount Saved With Project Dollars/Month
$11208.33	$11208.33	$0.00	$69212.54	$69212.54	$0.00
$11208.33	$11208.33	$0.00	$64552.30	$64552.30	$0.00
$11208.33	$11208.33	$0.00	$59488.77	$59488.77	$0.00
$11208.33	$11208.33	$0.00	$55052.58	$55052.58	$0.00
$11208.33	$11208.33	$0.00	$45732.10	$45732.10	$0.00
$11208.33	$11208.33	$0.00	$42012.87	$42012.87	$0.00
$11208.33	$11208.33	$0.00	$37442.25	$37442.25	$0.00
$11208.33	$11208.33	$0.00	$39010.60	$39010.60	$0.00
$11208.33	$11208.33	$0.00	$42774.64	$42774.64	$0.00
$11208.33	$11208.33	$0.00	$47434.88	$47434.88	$0.00
$11208.33	$11208.33	$0.00	$59981.68	$59981.68	$0.00
$11208.33	$11208.33	$0.00	$68226.72	$68226.72	$0.00
$134500.00	$134500.00	$0.00	$630921.93	$630921.93	$0.00
$11208.33	$11208.33	$0.00	$52576.83	$52576.83	$0.00

Computer Simulation: Condition; Only Beaverhead County Municipal Solid Waste

Input Vectors:

	Monthly Natural Gas Usage (Historical) in MCF per Month	Total Available Solid Waste in Tons per Year	Total Solid Waste to be Used in Tons per Year	Current Cost of a MCF of Natural Gas in Dollars per MCF	Solid Waste Removal From Campus of WMC in Dollars per Year
January	8340	8084	4477	4.481	2712
February	7300				
March	6170	Estimated Annual Cost of Natural Gas Usage in Dollars per MSW Ton	Estimated Annual Cost of Dumping of Ash in Dollars per MSW Ton	Estimated Annual Cost of Electricity in Dollars per MSW Ton	Estimated Annual Cost of Parts & Supplies in Dollars per MSW Ton
April	5180				
May	3100				
June	2270				
July	1250	1.20	1.70	1.00	4.00
August	1600				
September	2440				
October	3480				
November	6280				
December	8120				

Computer Simulation: Condition; Only Beaverhead County Municipal Solid Waste

Solid Waste Removal From Campus After Project: $/Year	Current Cost of Labor to Operate Existing Facility: $/Year	Current Cost to Operate Beaverhead County Landfill: $/Year	Current Cost to Operate Madison County Landfill: $/Yr	Estimated Annual Debt Service for Project in Dollars per Year	Total Available Wood Waste in Tons per Year
0	140000	104880	134500	178600	8000

Estimated Annual Cost of Other Expenses in Dollars per MSW Ton	Estimated Cost of Labor to Operate New/Both Facilities: $/Year	Cost to Operate Beaverhead Landfill After Project: $/Year	Cost to Operate Madison County Landfill After the Project: $/Year	Total Tipping Fees to be Collected With This Project: $/Year	Estimated Cost of Wood Waste in Dollars per Ton
3.00	110000	26220	134500	0	4.00

Computer Simulation: Condition; Only Beaverhead County Municipal Solid Waste

Month of Year	Western Montana Natural Gas Usage Average Over Month MCF/Day	Western Montana Required Energy Average Over Month MMBtu/Day	Western Montana Required Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Available Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Solid Waste Used Average Over Month Tons/Day
January	269.0	234.9	50.52	16.43	9.10
February	258.4	225.6	48.52	15.02	8.32
March	199.0	173.8	37.37	17.60	9.75
April	172.7	150.8	32.42	22.37	12.39
May	100.0	87.3	18.78	39.12	21.66
June	75.7	66.1	14.21	26.00	14.40
July	40.3	35.2	7.57	25.69	14.23
August	51.6	45.1	9.69	24.64	13.65
September	81.3	71.0	15.27	19.81	10.97
October	112.3	98.0	21.08	20.08	11.12
November	209.3	182.8	39.31	20.34	11.27
December	261.9	228.7	49.19	17.86	9.89
Total	1831.6	1599.3	343.94	264.96	146.74
Average	152.6	133.3	28.66	22.08	12.23

Computer Simulation: Condition; Only Beaverhead County Municipal Solid Waste

Beaverhead/Madison Required Wood to Make up Difference	Western Montana Required Natural Gas Start up/Make up	Western Montana Natural Gas Cost Without Project	Western Montana Solid Waste Removal Cost Without Project	Beaverhead County Landfill Operations Cost Without Project	Madison County Landfill Operations Cost Without Project
Tons/Day	MCF/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
23.01	6913.5	$37371.54	$226.00	$8740.00	$11208.33
22.34	6111.2	$32711.30	$226.00	$8740.00	$11208.33
15.35	4641.6	$27647.77	$226.00	$8740.00	$11208.33
11.13	3300.6	$23211.58	$226.00	$8740.00	$11208.33
0.00	179.8	$13891.10	$226.00	$8740.00	$11208.33
0.00	115.7	$10171.87	$226.00	$8740.00	$11208.33
0.00	118.1	$5601.25	$226.00	$8740.00	$11208.33
0.00	113.3	$7169.60	$226.00	$8740.00	$11208.33
2.39	775.7	$10933.64	$226.00	$8740.00	$11208.33
5.53	1736.5	$15593.88	$226.00	$8740.00	$11208.33
15.58	4570.5	$28140.68	$226.00	$8740.00	$11208.33
21.83	6569.0	$36385.72	$226.00	$8740.00	$11208.33
117.16	35145.5	$248829.93	$2712.00	$104980.00	$134500.00
9.76	2928.8	$20735.83	$226.00	$8740.00	$11208.33

Computer Simulation: Condition; Only Beaverhead County Municipal Solid Waste

Coalition Natural Gas Cost With Project	Western Montana Solid Waste Removal Cost With Project	Beaverhead County Dumping Solid Waste Tipping Fees	Coalition Dumping Ash All Cost Necessary	Western Montana Labor/Operation Cost Without Project	Coalition Labor/Operation Cost With Project
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$30979.36	$0.00	$0.00	$479.49	$11666.67	$9166.67
$27384.49	$0.00	$0.00	$399.57	$11666.67	$9166.67
$20799.01	$0.00	$0.00	$513.74	$11666.67	$9166.67
$14790.14	$0.00	$0.00	$631.70	$11666.67	$9166.67
$805.86	$0.00	$0.00	$1141.64	$11666.67	$9166.67
$518.44	$0.00	$0.00	$734.45	$11666.67	$9166.67
$529.18	$0.00	$0.00	$749.67	$11666.67	$9166.67
$507.69	$0.00	$0.00	$719.23	$11666.67	$9166.67
$3476.10	$0.00	$0.00	$559.40	$11666.67	$9166.67
$7781.22	$0.00	$0.00	$586.04	$11666.67	$9166.67
$20480.21	$0.00	$0.00	$574.62	$11666.67	$9166.67
$29435.50	$0.00	$0.00	$521.35	$11666.67	$9166.67
$157487.20	$0.00	$0.00	$7610.90	$140000.00	$110000.00
$13123.93	$0.00	$0.00	$634.24	$11666.67	$9166.67

Computer Simulation: Condition; Only Beaverhead County Municipal Solid Waste

Coalition Additional Electricity Cost With Project	Coalition Parts and Supplies Cost With Project	Coalition Other Annual Cost With Project	Beaverhead County Landfill Operations With Project	Madison County Landfill Operations With Project	Coalition Debt Services Average Over Year
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$482.05	$1128.20	$846.15	$2185.00	$11208.33	$14883.33
$435.04	$940.17	$705.13	$2185.00	$11208.33	$14883.33
$502.20	$1208.79	$906.59	$2185.00	$11208.33	$14883.33
$571.59	$1486.36	$1114.77	$2185.00	$11208.33	$14883.33
$871.55	$2686.20	$2014.65	$2185.00	$11208.33	$14883.33
$632.03	$1728.12	$1296.09	$2185.00	$11208.33	$14883.33
$640.98	$1763.94	$1322.95	$2185.00	$11208.33	$14883.33
$623.08	$1692.31	$1269.23	$2185.00	$11208.33	$14883.33
$529.06	$1316.24	$987.18	$2185.00	$11208.33	$14883.33
$544.73	$1378.92	$1034.19	$2185.00	$11208.33	$14883.33
$538.01	$1352.05	$1014.04	$2185.00	$11208.33	$14883.33
$506.67	$1226.70	$920.02	$2185.00	$11208.33	$14883.33
$6877.00	$17908.00	$13431.00	$26220.00	$134500.00	$178600.00
$573.08	$1492.33	$1119.25	$2185.00	$11208.33	$14883.33

Computer Simulation: Condition; Only Beaverhead County Municipal Solid Waste

Western Montana Total Cost Without Project Dollars/Month	Western Montana Total Cost With Project Dollars/Month	Western Montana Total Amount Saved With Project Dollars/Month	Beaverhead County Total Cost Without Project Dollars/Month	Beaverhead County Total Cost With Project Dollars/Month	Beaverhead County Total Amount Saved With Project Dollars/Month
$49264.21	$56497.31	($7233.10)	$8740.00	$3893.19	$4846.81
$44603.97	$52674.44	($8070.48)	$8740.00	$3625.24	$5114.76
$39540.44	$46414.67	($6874.23)	$8740.00	$4008.03	$4731.97
$35104.25	$40742.36	($5638.11)	$8740.00	$4403.57	$4336.43
$25783.77	$28212.88	($2429.11)	$8740.00	$6113.34	$2626.67
$22064.54	$26763.78	($4699.25)	$8740.00	$4748.07	$3991.93
$17493.92	$26817.96	($9324.04)	$8740.00	$4799.11	$3940.89
$19062.27	$26709.61	($7647.35)	$8740.00	$4697.04	$4042.96
$22826.31	$29222.04	($6395.73)	$8740.00	$4161.14	$4578.86
$27486.55	$33603.16	($6116.61)	$8740.00	$4250.46	$4489.54
$40033.35	$46269.58	($6236.23)	$8740.00	$4212.18	$4527.82
$48278.39	$55072.87	($6794.48)	$8740.00	$4033.54	$4706.46
$391541.93	$469000.65	($77458.72)	$104880.00	$52944.90	$51935.10
$32628.49	$39083.39	($6454.89)	$8740.00	$4412.08	$4327.93

Computer Simulation: Condition; Only Beaverhead County Municipal Solid Waste

Madison County Total Cost Without Project Dollars/Month	Madison County Total Cost With Project Dollars/Month	Madison County Total Amount Saved With Project Dollars/Month	Coalition Total Cost Without Project Dollars/Month	Coalition Total Cost With Project Dollars/Month	Coalition Total Amount Saved With Project Dollars/Month
$11208.33	$11208.33	$0.00	$69212.54	$71598.83	($2386.29)
$11208.33	$11208.33	$0.00	$64552.30	$67508.02	($2955.72)
$11208.33	$11208.33	$0.00	$59488.77	$61631.03	($2142.26)
$11208.33	$11208.33	$0.00	$55052.58	$56354.26	($1301.68)
$11208.33	$11208.33	$0.00	$45732.10	$45534.55	$197.55
$11208.33	$11208.33	$0.00	$42012.87	$42720.19	($707.32)
$11208.33	$11208.33	$0.00	$37442.25	$42825.40	($5383.15)
$11208.33	$11208.33	$0.00	$39010.60	$42614.98	($3604.38)
$11208.33	$11208.33	$0.00	$42774.64	$44591.51	($1816.87)
$11208.33	$11208.33	$0.00	$47434.88	$49061.94	($1627.06)
$11208.33	$11208.33	$0.00	$59981.68	$61690.09	($1708.41)
$11208.33	$11208.33	$0.00	$68226.72	$70314.75	($2088.03)
$134500.00	$134500.00	$0.00	$630921.93	$656445.55	($25523.62)
$11208.33	$11208.33	$0.00	$52576.83	$54703.80	($2126.97)

Computer Simulation: Condition; Both Beaverhead and Madison County Municipal Solid Waste

Input Vectors:

	Monthly Natural Gas Usage (Historical) in MCF per Month	Total Available Solid Waste in Tons per Year	Total Solid Waste to be Used in Tons per Year	Current Cost of a MCF of Natural Gas in Dollars per MCF	Solid Waste Removal From Campus of WMC in Dollars per Year
Janusry	8340	8084	8084	4.481	2712
February	7300				
March	6170	Estimated Annual Cost	Estimated Annual Cost	Estimated Annual Cost	Estimated Annual Cost
April	5180	of Natural Gas Usage in	of Dumping of Ash in	of Electricity in	of Parts & Supplies in
May	3100	Dollars per MSW Ton	Dollars per MSW Ton	Dollars per MSW Ton	Dollars per MSW Ton
June	2270				
July	1250	1.20	1.70	1.00	4.00
August	1600				
September	2440				
October	3480				
November	6280				
December	8120				

Computer Simulation: Condition; Both Beaverhead and Madison County Municipal Solid Waste

Solid Waste Removal From Campus After Project: $/Year	Current Cost of Labor to Operate Existing Facility: $/Year	Current Cost to Operate Beaverhead County Landfill: $/Year	Current Cost to Operate Madison County Landfill: $/Yr	Estimated Annual Debt Service for Project in Dollars per Year	Total Available Wood Waste in Tons per Year
0	140000	104880	134500	261500	8000

Estimated Annual Cost of Other Expenses in Dollars per MSW Ton	Estimated Cost of Labor to Operate New/Both Facilities: $/Year	Cost to Operate Beaverhead Landfill After Project: $/Year	Cost to Operate Madison County Landfill After the Project: $/Year	Total Tipping Fees to be Collected With This Project: $/Year	Estimated Cost of Wood Waste in Dollars per Ton
3.00	110000	26220	53800	0	4.00

Computer Simulation: Condition; Both Beaverhead and Madison County Municipal Solid Waste

Month of Year	Western Montana Natural Gas Usage Average Over Month MCF/Day	Western Montana Required Energy Average Over Month MMBtu/Day	Western Montana Required Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Available Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Solid Waste Used Average Over Month Tons/Day
January	269.0	234.9	50.52	16.43	16.43
February	258.4	225.6	48.52	15.02	15.02
March	199.0	173.8	37.37	17.60	17.60
April	172.7	150.8	32.42	22.37	22.37
May	100.0	87.3	18.78	39.12	39.12
June	75.7	66.1	14.21	26.00	26.00
July	40.3	35.2	7.57	25.69	25.69
August	51.6	45.1	9.69	24.64	24.64
September	81.3	71.0	15.27	19.81	19.81
October	112.3	98.0	21.08	20.08	20.08
November	209.3	182.8	39.31	20.34	20.34
December	261.9	228.7	49.19	17.86	17.86
Total	1831.6	1599.3	343.94	264.96	264.96
Average	152.6	133.3	28.66	22.08	22.08

Computer Simulation: Condition; Both Beaverhead and Madison County Municipal Solid Waste

Beaverhead/Madison Required Wood to Make up Difference	Western Montana Required Natural Gas Start up/Make up	Western Montana Natural Gas Cost Without Project	Western Montana Solid Waste Removal Cost Without Project	Beaverhead County Landfill Operations Cost Without Project	Madison County Landfill Operations Cost Without Project
Tons/Day	MCF/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
18.94	5764.2	$37371.54	$226.00	$8740.00	$11208.33
18.61	5153.5	$32711.30	$226.00	$8740.00	$11208.33
10.98	3410.2	$27647.77	$226.00	$8740.00	$11208.33
5.59	1786.5	$23211.58	$226.00	$8740.00	$11208.33
0.00	324.7	$13891.10	$226.00	$8740.00	$11208.33
0.00	208.9	$10171.87	$226.00	$8740.00	$11208.33
0.00	213.2	$5601.25	$226.00	$8740.00	$11208.33
0.00	204.6	$7169.60	$226.00	$8740.00	$11208.33
0.00	159.1	$10933.64	$226.00	$8740.00	$11208.33
0.56	331.8	$15593.88	$226.00	$8740.00	$11208.33
10.54	3193.1	$28140.68	$226.00	$8740.00	$11208.33
17.40	5319.3	$36385.72	$226.00	$8740.00	$11208.33
82.61	26069.2	$248829.93	$2712.00	$104880.00	$134500.00
6.88	2172.4	$20735.83	$226.00	$8740.00	$11208.33

Computer Simulation: Condition; Both Beaverhead and Madison County Municipal Solid Waste

Coalition Natural Gas Cost With Project	Western Montana Solid Waste Removal Cost With Project	Beaverhead County Dumping Solid Waste Tipping Fees	Coalition Dumping Ash All Cost Necessary	Western Montana Labor/Operation Cost Without Project	Coalition Labor/Operation Cost With Project
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$25829.36	$0.00	$0.00	$865.80	$11666.67	$9166.67
$23092.81	$0.00	$0.00	$721.50	$11666.67	$9166.67
$15281.14	$0.00	$0.00	$927.64	$11666.67	$9166.67
$8005.21	$0.00	$0.00	$1140.65	$11666.67	$9166.67
$1455.12	$0.00	$0.00	$2061.42	$11666.67	$9166.67
$936.13	$0.00	$0.00	$1326.18	$11666.67	$9166.67
$955.53	$0.00	$0.00	$1353.67	$11666.67	$9166.67
$916.73	$0.00	$0.00	$1298.69	$11666.67	$9166.67
$713.01	$0.00	$0.00	$1010.10	$11666.67	$9166.67
$1486.77	$0.00	$0.00	$1058.20	$11666.67	$9166.67
$14308.38	$0.00	$0.00	$1037.58	$11666.67	$9166.67
$23835.89	$0.00	$0.00	$941.38	$11666.67	$9166.67
$116816.07	$0.00	$0.00	$13742.80	$140000.00	$110000.00
$9734.67	$0.00	$0.00	$1145.23	$11666.67	$9166.67

Computer Simulation: Condition; Both Beaverhead and Madison County Municipal Solid Waste

Coalition Additional Electricity Cost With Project	Coalition Parts and Supplies Cost With Project	Coalition Other Annual Cost With Project	Beaverhead County Landfill Operations With Project	Madison County Landfill Operations With Project	Coalition Debt Services Average Over Year
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$709.29	$2037.17	$1527.88	$2185.00	$4483.33	$21791.67
$624.41	$1697.64	$1273.23	$2185.00	$4483.33	$21791.67
$745.67	$2182.68	$1637.01	$2185.00	$4483.33	$21791.67
$870.97	$2683.89	$2012.92	$2185.00	$4483.33	$21791.67
$1412.60	$4850.40	$3637.80	$2185.00	$4483.33	$21791.67
$980.11	$3120.42	$2340.32	$2185.00	$4483.33	$21791.67
$996.27	$3185.10	$2388.82	$2185.00	$4483.33	$21791.67
$963.94	$3055.75	$2291.81	$2185.00	$4483.33	$21791.67
$794.17	$2376.70	$1782.52	$2185.00	$4483.33	$21791.67
$822.47	$2489.87	$1867.40	$2185.00	$4483.33	$21791.67
$810.34	$2441.37	$1831.03	$2185.00	$4483.33	$21791.67
$753.75	$2215.02	$1661.26	$2185.00	$4483.33	$21791.67
$10484.00	$32336.00	$24252.00	$26220.00	$53800.00	$261500.00
$873.67	$2694.67	$2021.00	$2185.00	$4483.33	$21791.67

Computer Simulation: Condition; Both Beaverhead and Madison County Municipal Solid Waste

Western Montana Total Cost Without Project Dollars/Month	Western Montana Total Cost With Project Dollars/Month	Western Montana Total Amount Saved With Project Dollars/Month	Beaverhead County Total Cost Without Project Dollars/Month	Beaverhead County Total Cost With Project Dollars/Month	Beaverhead County Total Amount Saved With Project Dollars/Month
$49264.21	$59357.76	($10093.55)	$8740.00	$5188.46	$3551.54
$44603.97	$56209.54	($11605.57)	$8740.00	$4704.64	$4035.36
$39540.44	$48985.98	($9445.54)	$8740.00	$5395.82	$3344.18
$35104.25	$42317.76	($7213.51)	$8740.00	$6110.04	$2629.96
$25783.77	$38394.56	($12610.80)	$8740.00	$9197.32	($457.32)
$22064.54	$35777.97	($13713.44)	$8740.00	$6732.10	$2007.90
$17493.92	$35875.79	($18381.87)	$8740.00	$6824.26	$1915.74
$19062.27	$35680.16	($16617.89)	$8740.00	$6639.95	$2100.05
$22826.31	$34653.09	($11826.78)	$8740.00	$5672.29	$3067.71
$27486.55	$35564.07	($8077.52)	$8740.00	$5833.57	$2906.43
$40033.35	$48326.87	($8293.53)	$8740.00	$5764.45	$2975.55
$48278.39	$57579.93	($9301.54)	$8740.00	$5441.90	$3298.10
$391541.93	$528723.47	($137181.54)	$104880.00	$73504.80	$31375.20
$32628.49	$44060.29	($11431.79)	$8740.00	$6125.40	$2614.60

Computer Simulation: Condition; Both Beaverhead and Madison County Municipal Solid Waste

Madison County Total Cost Without Project Dollars/Month	Madison County Total Cost With Project Dollars/Month	Madison County Total Amount Saved With Project Dollars/Month	Coalition Total Cost Without Project Dollars/Month	Coalition Total Cost With Project Dollars/Month	Coalition Total Amount Saved With Project Dollars/Month
$11208.33	$4483.33	$6725.00	$69212.54	$69029.55	$182.99
$11208.33	$4483.33	$6725.00	$64552.30	$65397.51	($845.21)
$11208.33	$4483.33	$6725.00	$59488.77	$58865.13	$623.64
$11208.33	$4483.33	$6725.00	$55052.58	$52911.13	$2141.45
$11208.33	$4483.33	$6725.00	$45732.10	$52075.22	($6343.12)
$11208.33	$4483.33	$6725.00	$42012.87	$46993.41	($4980.54)
$11208.33	$4483.33	$6725.00	$37442.25	$47183.39	($9741.14)
$11208.33	$4483.33	$6725.00	$39010.60	$46803.44	($7792.84)
$11208.33	$4483.33	$6725.00	$42774.64	$44808.71	($2034.07)
$11208.33	$4483.33	$6725.00	$47434.88	$45880.97	$1553.91
$11208.33	$4483.33	$6725.00	$59981.68	$58574.65	$1407.03
$11208.33	$4483.33	$6725.00	$68226.72	$67505.16	$721.56
$134500.00	$53800.00	$80700.00	$630921.93	$656028.27	($25106.34)
$11208.33	$4483.33	$6725.00	$52576.83	$54669.02	($2092.19)

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County Municipal Solid Waste

Input Vectors:

	Monthly Natural Gas Usage (Historical) in MCF per Month	Total Available Solid Waste in Tons per Year	Total Solid Waste to be Used in Tons per Year	Current Cost of a MCF of Natural Gas in Dollars per MCF	Solid Waste Removal From Campus of WMC in Dollars per Year
January	8340	8084	6231	4.481	2712
February	7300				
March	6170	Estimated Annual Cost of Natural Gas Usage in Dollars per MSW Ton	Estimated Annual Cost of Dumping of Ash in Dollars per MSW Ton	Estimated Annual Cost of Electricity in Dollars per MSW Ton	Estimated Annual Cost of Parts & Supplies in Dollars per MSW Ton
April	5180				
May	3100				
June	2270				
July	1250	1.20	1.70	1.00	4.00
August	1600				
September	2440				
October	3480				
November	6280				
December	8120				

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County Municipal Solid Waste

Solid Waste Removal From Campus After Project: $/Year	Current Cost of Labor to Operate Existing Facility: $/Year	Current Cost to Operate Beaverhead County Landfill: $/Year	Current Cost to Operate Madison County Landfill: $/Yr	Estimated Annual Debt Service for Project in Dollars per Year	Total Available Wood Waste in Tons per Year
0	140000	104880	134500	178600	8000

Estimated Annual Cost of Other Expenses in Dollars per MSW Ton	Estimated Cost of Labor to Operate New/Both Facilities: $/Year	Cost to Operate Beaverhead Landfill After Project: $/Year	Cost to Operate Madison County Landfill After the Project: $/Year	Total Tipping Fees to be Collected With This Project: $/Year	Estimated Cost of Wood Waste in Dollars per Ton
3.00	110000	30000	94150	0	4.00

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County Municipal Solid Waste

Month of Year	Western Montana Natural Gas Usage Average Over Month MCF/Day	Western Montana Required Energy Average Over Month MMBtu/Day	Western Montana Required Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Available Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Solid Waste Used Average Over Month Tons/Day
January	269.0	234.9	50.52	16.43	12.66
February	258.4	225.6	48.52	15.02	11.58
March	199.0	173.8	37.37	17.60	13.57
April	172.7	150.8	32.42	22.37	17.24
May	100.0	87.3	18.78	39.12	30.15
June	75.7	66.1	14.21	26.00	20.04
July	40.3	35.2	7.57	25.69	19.80
August	51.6	45.1	9.69	24.64	18.99
September	81.3	71.0	15.27	19.81	15.27
October	112.3	98.0	21.08	20.08	15.48
November	209.3	182.8	39.31	20.34	15.68
December	261.9	228.7	49.19	17.86	13.77
Total	1831.6	1599.3	343.94	264.96	204.23
Average	152.6	133.3	28.66	22.08	17.02

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County Municipal Solid Waste

Beaverhead/Madison Required Wood to Make up Difference	Western Montana Required Natural Gas Start up/Make up	Western Montana Natural Gas Cost Without Project	Western Montana Solid Waste Removal Cost Without Project	Beaverhead County Landfill Operations Cost Without Project	Madison County Landfill Operations Cost Without Project
Tons/Day	MCF/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
21.03	6354.6	$37371.54	$226.00	$8740.00	$11208.33
20.52	5645.5	$32711.30	$226.00	$8740.00	$11208.33
13.23	4042.8	$27647.77	$226.00	$8740.00	$11208.33
8.44	2564.3	$23211.58	$226.00	$8740.00	$11208.33
0.00	250.3	$13891.10	$226.00	$8740.00	$11208.33
0.00	161.0	$10171.87	$226.00	$8740.00	$11208.33
0.00	164.4	$5601.25	$226.00	$8740.00	$11208.33
0.00	157.7	$7169.60	$226.00	$8740.00	$11208.33
0.00	123.7	$10933.64	$226.00	$8740.00	$11208.33
3.11	1053.4	$15593.88	$226.00	$8740.00	$11208.33
13.13	3900.7	$28140.68	$226.00	$8740.00	$11208.33
19.68	5961.3	$36385.72	$226.00	$8740.00	$11208.33
99.14	30379.8	$248829.93	$2712.00	$104880.00	$134500.00
8.26	2531.6	$20735.83	$226.00	$8740.00	$11208.33

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County Municipal Solid Waste

Coalition Natural Gas Cost With Project	Western Montana Solid Waste Removal Cost With Project	Beaverhead County Dumping Solid Waste Tipping Fees	Coalition Dumping Ash All Cost Necessary	Western Montana Labor/Operation Cost Without Project	Coalition Labor/Operation Cost With Project
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$28475.03	$0.00	$0.00	$667.34	$11666.67	$9166.67
$25297.55	$0.00	$0.00	$556.12	$11666.67	$9166.67
$18115.80	$0.00	$0.00	$715.01	$11666.67	$9166.67
$11490.79	$0.00	$0.00	$879.19	$11666.67	$9166.67
$1121.58	$0.00	$0.00	$1588.91	$11666.67	$9166.67
$721.55	$0.00	$0.00	$1022.20	$11666.67	$9166.67
$736.50	$0.00	$0.00	$1043.38	$11666.67	$9166.67
$706.60	$0.00	$0.00	$1001.01	$11666.67	$9166.67
$554.38	$0.00	$0.00	$778.56	$11666.67	$9166.67
$4720.37	$0.00	$0.00	$815.64	$11666.67	$9166.67
$17479.00	$0.00	$0.00	$799.75	$11666.67	$9166.67
$26712.54	$0.00	$0.00	$725.60	$11666.67	$9166.67
$136131.69	$0.00	$0.00	$10592.70	$140000.00	$110000.00
$11344.31	$0.00	$0.00	$882.73	$11666.67	$9166.67

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County Municipal Solid Waste

Coalition Additional Electricity Cost With Project	Coalition Parts and Supplies Cost With Project	Coalition Other Annual Cost With Project	Beaverhead County Landfill Operations With Project	Madison County Landfill Operations With Project	Coalition Debt Services Average Over Year
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$592.55	$1570.21	$1177.66	$2500.00	$7845.83	$14883.33
$527.13	$1308.51	$981.38	$2500.00	$7845.83	$14883.33
$620.59	$1682.37	$1261.78	$2500.00	$7845.83	$14883.33
$717.17	$2068.69	$1551.52	$2500.00	$7845.83	$14883.33
$1134.65	$3738.60	$2803.95	$2500.00	$7845.83	$14883.33
$801.29	$2405.17	$1803.87	$2500.00	$7845.83	$14883.33
$813.75	$2455.01	$1841.26	$2500.00	$7845.83	$14883.33
$788.83	$2355.32	$1766.49	$2500.00	$7845.83	$14883.33
$657.98	$1831.91	$1373.94	$2500.00	$7845.83	$14883.33
$679.79	$1919.15	$1439.36	$2500.00	$7845.83	$14883.33
$670.44	$1881.76	$1411.32	$2500.00	$7845.83	$14883.33
$626.82	$1707.29	$1280.47	$2500.00	$7845.83	$14883.33
$8631.00	$24924.00	$18693.00	$30000.00	$94150.00	$178600.00
$719.25	$2077.00	$1557.75	$2500.00	$7845.83	$14883.33

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County Municipal Solid Waste

Western Montana Total Cost Without Project Dollars/Month	Western Montana Total Cost With Project Dollars/Month	Western Montana Total Amount Saved With Project Dollars/Month	Beaverhead County Total Cost Without Project Dollars/Month	Beaverhead County Total Cost With Project Dollars/Month	Beaverhead County Total Amount Saved With Project Dollars/Month
$49264.21	$54528.92	($5264.71)	$8740.00	$4838.05	$3901.95
$44603.97	$51034.11	($6430.15)	$8740.00	$4465.13	$4274.87
$39540.44	$44305.67	($4765.24)	$8740.00	$4997.88	$3742.12
$35104.25	$38149.08	($3044.83)	$8740.00	$5548.39	$3191.61
$25783.77	$29804.63	($4020.87)	$8740.00	$7928.01	$812.00
$22064.54	$27787.81	($5723.28)	$8740.00	$6027.86	$2712.14
$17493.92	$27863.21	($10369.29)	$8740.00	$6098.89	$2641.11
$19062.27	$27712.42	($8650.15)	$8740.00	$5956.83	$2783.17
$22826.31	$26925.58	($4099.27)	$8740.00	$5210.98	$3529.02
$27486.55	$31197.34	($3710.79)	$8740.00	$5335.29	$3404.71
$40033.35	$43910.63	($3877.28)	$8740.00	$5282.01	$3457.99
$48278.39	$52932.63	($4654.24)	$8740.00	$5033.39	$3706.61
$391541.93	$456152.04	($64610.11)	$104880.00	$66722.70	$38157.30
$32628.49	$38012.67	($5384.18)	$8740.00	$5560.23	$3179.78

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County Municipal Solid Waste

Madison County Total Cost Without Project Dollars/Month	Madison County Total Cost With Project Dollars/Month	Madison County Total Amount Saved With Project Dollars/Month	Coalition Total Cost Without Project Dollars/Month	Coalition Total Cost With Project Dollars/Month	Coalition Total Amount Saved With Project Dollars/Month
$11208.33	$7845.83	$3362.50	$69212.54	$67212.80	$1999.74
$11208.33	$7845.83	$3362.50	$64552.30	$63345.07	$1207.23
$11208.33	$7845.83	$3362.50	$59488.77	$57149.38	$2339.39
$11208.33	$7845.83	$3362.50	$55052.58	$51543.30	$3509.28
$11208.33	$7845.83	$3362.50	$45732.10	$45578.47	$153.63
$11208.33	$7845.83	$3362.50	$42012.87	$41661.51	$351.36
$11208.33	$7845.83	$3362.50	$37442.25	$41807.94	($4365.69)
$11208.33	$7845.83	$3362.50	$39010.60	$41515.08	($2504.48)
$11208.33	$7845.83	$3362.50	$42774.64	$39982.39	$2792.25
$11208.33	$7845.83	$3362.50	$47434.88	$44378.46	$3056.42
$11208.33	$7845.83	$3362.50	$59981.68	$57038.48	$2943.20
$11208.33	$7845.83	$3362.50	$68226.72	$65811.86	$2414.86
$134500.00	$94150.00	$40350.00	$630921.93	$617024.74	$13897.19
$11208.33	$7845.83	$3362.50	$52576.83	$51418.73	$1158.10

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $100,000 Grant

Input Vectors:

	Monthly Natural Gas Usage (Historical) in MCF per Month	Total Available Solid Waste in Tons per Year	Total Solid Waste to be Used in Tons per Year	Current Cost of a MCF of Natural Gas in Dollars per MCF	Solid Waste Removal From Campus of WMC in Dollars per Year
January	8340	8084	6231	4.481	2712
February	7300				
March	6170	Estimated Annual Cost of Natural Gas Usage in Dollars per MSW Ton	Estimated Annual Cost of Dumping of Ash in Dollars per MSW Ton	Estimated Annual Cost of Electricity in Dollars per MSW Ton	Estimated Annual Cost of Parts & Supplies in Dollars per MSW Ton
April	5180				
May	3100				
June	2270				
July	1250	1.20	1.70	1.00	4.00
August	1600				
September	2440				
October	3480				
November	6280				
December	8120				

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $100,000 Grant

Solid Waste Removal From Campus After Project: $/Year	Current Cost of Labor to Operate Existing Facility: $/Year	Current Cost to Operate Beaverhead County Landfill: $/Year	Current Cost to Operate Madison County Landfill: $/Yr	Estimated Annual Debt Service for Project in Dollars per Year	Total Available Wood Waste in Tons per Year
0	140000	104880	134500	165200	8000

Estimated Annual Cost of Other Expenses in Dollars per MSW Ton	Estimated Cost of Labor to Operate New/Both Facilities: $/Year	Cost to Operate Beaverhead Landfill After Project: $/Year	Cost to Operate Madison County Landfill After the Project: $/Year	Total Tipping Fees to be Collected With This Project: $/Year	Estimated Cost of Wood Waste in Dollars per Ton
3.00	110000	30000	94150	0	4.00

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $100,000 Grant

Month of Year	Western Montana Natural Gas Usage Average Over Month MCF/Day	Western Montana Required Energy Average Over Month MMBtu/Day	Western Montana Required Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Available Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Solid Waste Used Average Over Month Tons/Day
January	269.0	234.9	50.52	16.43	12.66
February	258.4	225.6	48.52	15.02	11.58
March	199.0	173.8	37.37	17.60	13.57
April	172.7	150.8	32.42	22.37	17.24
May	100.0	87.3	18.78	39.12	30.15
June	75.7	66.1	14.21	26.00	20.04
July	40.3	35.2	7.57	25.69	19.80
August	51.6	45.1	9.69	24.64	18.99
September	81.3	71.0	15.27	19.81	15.27
October	112.3	98.0	21.08	20.08	15.48
November	209.3	182.8	39.31	20.34	15.68
December	261.9	228.7	49.19	17.86	13.77
Total	1831.6	1599.3	343.94	264.96	204.23
Average	152.6	133.3	28.66	22.08	17.02

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $100,000 Grant

Beaverhead/Madison Required Wood to Make up Difference	Western Montana Required Natural Gas Start up/Make up	Western Montana Natural Gas Cost Without Project	Western Montana Solid Waste Removal Cost Without Project	Beaverhead County Landfill Operations Cost Without Project	Madison County Landfill Operations Cost Without Project
Tons/Day	MCF/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
21.03	6354.6	$37371.54	$226.00	$8740.00	$11208.33
20.52	5645.5	$32711.30	$226.00	$8740.00	$11208.33
13.23	4042.8	$27647.77	$226.00	$8740.00	$11208.33
8.44	2564.3	$23211.58	$226.00	$8740.00	$11208.33
0.00	250.3	$13891.10	$226.00	$8740.00	$11208.33
0.00	161.0	$10171.87	$226.00	$8740.00	$11208.33
0.00	164.4	$5601.25	$226.00	$8740.00	$11208.33
0.00	157.7	$7169.60	$226.00	$8740.00	$11208.33
0.00	123.7	$10933.64	$226.00	$8740.00	$11208.33
3.11	1053.4	$15593.88	$226.00	$8740.00	$11208.33
13.13	3900.7	$28140.68	$226.00	$8740.00	$11208.33
19.68	5961.3	$36385.72	$226.00	$8740.00	$11208.33
99.14	30379.8	$248829.93	$2712.00	$104880.00	$134500.00
8.26	2531.6	$20735.83	$226.00	$8740.00	$11208.33

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $100,000 Grant

Coalition Natural Gas Cost With Project	Western Montana Solid Waste Removal Cost With Project	Beaverhead County Dumping Solid Waste Tipping Fees	Coalition Dumping Ash All Cost Necessary	Western Montana Labor/Operation Cost Without Project	Coalition Labor/Operation Cost With Project
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$28475.03	$0.00	$0.00	$667.34	$11666.67	$9166.67
$25297.55	$0.00	$0.00	$556.12	$11666.67	$9166.67
$18115.80	$0.00	$0.00	$715.01	$11666.67	$9166.67
$11490.79	$0.00	$0.00	$879.19	$11666.67	$9166.67
$1121.58	$0.00	$0.00	$1588.91	$11666.67	$9166.67
$721.55	$0.00	$0.00	$1022.20	$11666.67	$9166.67
$736.50	$0.00	$0.00	$1043.38	$11666.67	$9166.67
$706.60	$0.00	$0.00	$1001.01	$11666.67	$9166.67
$554.38	$0.00	$0.00	$778.56	$11666.67	$9166.67
$4720.37	$0.00	$0.00	$815.64	$11666.67	$9166.67
$17479.00	$0.00	$0.00	$799.75	$11666.67	$9166.67
$26712.54	$0.00	$0.00	$725.60	$11666.67	$9166.67
$136131.69	$0.00	$0.00	$10592.70	$140000.00	$110000.00
$11344.31	$0.00	$0.00	$882.73	$11666.67	$9166.67

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $100,000 Grant

Coalition Additional Electricity Cost With Project	Coalition Parts and Supplies Cost With Project	Coalition Other Annual Cost With Project	Beaverhead County Landfill Operations With Project	Madison County Landfill Operations With Project	Coalition Debt Services Average Over Year
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$592.55	$1570.21	$1177.66	$2500.00	$7845.83	$13766.67
$527.13	$1308.51	$981.38	$2500.00	$7845.83	$13766.67
$620.59	$1682.37	$1261.78	$2500.00	$7845.83	$13766.67
$717.17	$2068.69	$1551.52	$2500.00	$7845.83	$13766.67
$1134.65	$3738.60	$2803.95	$2500.00	$7845.83	$13766.67
$801.29	$2405.17	$1803.87	$2500.00	$7845.83	$13766.67
$813.75	$2455.01	$1841.26	$2500.00	$7845.83	$13766.67
$788.83	$2355.32	$1766.49	$2500.00	$7845.83	$13766.67
$657.98	$1831.91	$1373.94	$2500.00	$7845.83	$13766.67
$679.79	$1919.15	$1439.36	$2500.00	$7845.83	$13766.67
$670.44	$1881.76	$1411.32	$2500.00	$7845.83	$13766.67
$626.82	$1707.29	$1280.47	$2500.00	$7845.83	$13766.67
$8631.00	$24924.00	$18693.00	$30000.00	$94150.00	$165200.00
$719.25	$2077.00	$1557.75	$2500.00	$7845.83	$13766.67

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $100,000 Grant

Western Montana Total Cost Without Project Dollars/Month	Western Montana Total Cost With Project Dollars/Month	Western Montana Total Amount Saved With Project Dollars/Month	Beaverhead County Total Cost Without Project Dollars/Month	Beaverhead County Total Cost With Project Dollars/Month	Beaverhead County Total Amount Saved With Project Dollars/Month
$49264.21	$53412.25	($4148.04)	$8740.00	$4838.05	$3901.95
$44603.97	$49917.45	($5313.48)	$8740.00	$4465.13	$4274.87
$39540.44	$43189.01	($3648.57)	$8740.00	$4997.88	$3742.12
$35104.25	$37032.41	($1928.16)	$8740.00	$5548.39	$3191.61
$25783.77	$28687.97	($2904.20)	$8740.00	$7928.01	$812.00
$22064.54	$26671.15	($4606.61)	$8740.00	$6027.86	$2712.14
$17493.92	$26746.54	($9252.63)	$8740.00	$6098.89	$2641.11
$19062.27	$26595.75	($7533.49)	$8740.00	$5956.83	$2783.17
$22826.31	$25808.91	($2982.61)	$8740.00	$5210.98	$3529.02
$27486.55	$30080.67	($2594.13)	$8740.00	$5335.29	$3404.71
$40033.35	$42793.96	($2760.62)	$8740.00	$5282.01	$3457.99
$48278.39	$51815.96	($3537.58)	$8740.00	$5033.39	$3706.61
$391541.93	$442752.04	($51210.11)	$104880.00	$66722.70	$38157.30
$32628.49	$36896.00	($4267.51)	$8740.00	$5560.23	$3179.78

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $100,000 Grant

Madison County Total Cost Without Project Dollars/Month	Madison County Total Cost With Project Dollars/Month	Madison County Total Amount Saved With Project Dollars/Month	Coalition Total Cost Without Project Dollars/Month	Coalition Total Cost With Project Dollars/Month	Coalition Total Amount Saved With Project Dollars/Month
$11208.33	$7845.83	$3362.50	$69212.54	$66096.14	$3116.40
$11208.33	$7845.83	$3362.50	$64552.30	$62228.41	$2323.89
$11208.33	$7845.83	$3362.50	$59488.77	$56032.72	$3456.05
$11208.33	$7845.83	$3362.50	$55052.58	$50426.63	$4625.95
$11208.33	$7845.83	$3362.50	$45732.10	$44461.80	$1270.30
$11208.33	$7845.83	$3362.50	$42012.87	$40544.84	$1468.03
$11208.33	$7845.83	$3362.50	$37442.25	$40691.27	($3249.02)
$11208.33	$7845.83	$3362.50	$39010.60	$40398.41	($1387.81)
$11208.33	$7845.83	$3362.50	$42774.64	$38865.72	$3908.92
$11208.33	$7845.83	$3362.50	$47434.88	$43261.79	$4173.09
$11208.33	$7845.83	$3362.50	$59981.68	$55921.81	$4059.87
$11208.33	$7845.83	$3362.50	$68226.72	$64695.19	$3531.53
$134500.00	$94150.00	$40350.00	$630921.93	$603624.74	$27297.19
$11208.33	$7845.83	$3362.50	$52576.83	$50302.06	$2274.77

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $500,000 Grant

Input Vectors:

	Monthly Natural Gas Usage (Historical) in MCF per Month	Total Available Solid Waste in Tons per Year	Total Solid Waste to be Used in Tons per Year	Current Cost of a MCF of Natural Gas in Dollars per MCF	Solid Waste Removal From Campus of WMC in Dollars per Year
January	8340	8084	6231	4.481	2712
February	7300				
March	6170	Estimated Annual Cost of Natural Gas Usage in Dollars per MSW Ton	Estimated Annual Cost of Dumping of Ash in Dollars per MSW Ton	Estimated Annual Cost of Electricity in Dollars per MSW Ton	Estimated Annual Cost of Parts & Supplies in Dollars per MSW Ton
April	5180				
May	3100				
June	2270				
July	1250	1.20	1.70	1.00	4.00
August	1600				
September	2440				
October	3480				
November	6280				
December	8120				

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $500,000 Grant

Solid Waste Removal From Campus After Project: $/Year	Current Cost of Labor to Operate Existing Facility: $/Year	Current Cost to Operate Beaverhead County Landfill: $/Year	Current Cost to Operate Madison County Landfill: $/Yr	Estimated Annual Debt Service for Project in Dollars per Year	Total Available Wood Waste in Tons per Year
0	140000	104880	134500	111700	8000

Estimated Annual Cost of Other Expenses in Dollars per MSW Ton	Estimated Cost of Labor to Operate New/Both Facilities: $/Year	Cost to Operate Beaverhead Landfill After Project: $/Year	Cost to Operate Madison County Landfill After the Project: $/Year	Total Tipping Fees to be Collected With This Project: $/Year	Estimated Cost of Wood Waste in Dollars per Ton
3.00	110000	30000	94150	0	4.00

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $500,000 Grant

Month of Year	Western Montana Natural Gas Usage Average Over Month MCF/Day	Western Montana Required Energy Average Over Month MMBtu/Day	Western Montana Required Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Available Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Solid Waste Used Average Over Month Tons/Day
January	269.0	234.9	50.52	16.43	12.66
February	258.4	225.6	48.52	15.02	11.58
March	199.0	173.8	37.37	17.60	13.57
April	172.7	150.8	32.42	22.37	17.24
May	100.0	87.3	18.78	39.12	30.15
June	75.7	66.1	14.21	26.00	20.04
July	40.3	35.2	7.57	25.69	19.80
August	51.6	45.1	9.69	24.64	18.99
September	81.3	71.0	15.27	19.81	15.27
October	112.3	98.0	21.08	20.08	15.48
November	209.3	182.8	39.31	20.34	15.68
December	261.9	228.7	49.19	17.86	13.77
Total	1831.6	1599.3	343.94	264.96	204.23
Average	152.6	133.3	28.66	22.08	17.02

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $500,000 Grant

Beaverhead/Madison Required Wood to Make up Difference	Western Montana Required Natural Gas Start up/Make up	Western Montana Natural Gas Cost Without Project	Western Montana Solid Waste Removal Cost Without Project	Beaverhead County Landfill Operations Cost Without Project	Madison County Landfill Operations Cost Without Project
Tons/Day	MCF/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
21.03	6354.6	$37371.54	$226.00	$8740.00	$11208.33
20.52	5645.5	$32711.30	$226.00	$8740.00	$11208.33
13.23	4042.8	$27647.77	$226.00	$8740.00	$11208.33
8.44	2564.3	$23211.58	$226.00	$8740.00	$11208.33
0.00	250.3	$13891.10	$226.00	$8740.00	$11208.33
0.00	161.0	$10171.87	$226.00	$8740.00	$11208.33
0.00	164.4	$5601.25	$226.00	$8740.00	$11208.33
0.00	157.7	$7169.60	$226.00	$8740.00	$11208.33
0.00	123.7	$10933.64	$226.00	$8740.00	$11208.33
3.11	1053.4	$15593.88	$226.00	$8740.00	$11208.33
13.13	3900.7	$28140.68	$226.00	$8740.00	$11208.33
19.68	5961.3	$36385.72	$226.00	$8740.00	$11208.33
99.14	30379.8	$248829.93	$2712.00	$104880.00	$134500.00
8.26	2531.6	$20735.83	$226.00	$8740.00	$11208.33

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $500,000 Grant

Coalition Natural Gas Cost With Project	Western Montana Solid Waste Removal Cost With Project	Beaverhead County Dumping Solid Waste Tipping Fees	Coalition Dumping Ash All Cost Necessary	Western Montana Labor/Operation Cost Without Project	Coalition Labor/Operation Cost With Project
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$28475.03	$0.00	$0.00	$667.34	$11666.67	$9166.67
$25297.55	$0.00	$0.00	$556.12	$11666.67	$9166.67
$18115.80	$0.00	$0.00	$715.01	$11666.67	$9166.67
$11490.79	$0.00	$0.00	$879.19	$11666.67	$9166.67
$1121.58	$0.00	$0.00	$1588.91	$11666.67	$9166.67
$721.55	$0.00	$0.00	$1022.20	$11666.67	$9166.67
$736.50	$0.00	$0.00	$1043.38	$11666.67	$9166.67
$706.60	$0.00	$0.00	$1001.01	$11666.67	$9166.67
$554.38	$0.00	$0.00	$778.56	$11666.67	$9166.67
$4720.37	$0.00	$0.00	$815.64	$11666.67	$9166.67
$17479.00	$0.00	$0.00	$799.75	$11666.67	$9166.67
$26712.54	$0.00	$0.00	$725.60	$11666.67	$9166.67
$136131.69	$0.00	$0.00	$10592.70	$140000.00	$110000.00
$11344.31	$0.00	$0.00	$882.73	$11666.67	$9166.67

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $500,000 Grant

Coalition Additional Electricity Cost With Project	Coalition Parts and Supplies Cost With Project	Coalition Other Annual Cost With Project	Beaverhead County Landfill Operations With Project	Madison County Landfill Operations With Project	Coalition Debt Services Average Over Year
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$592.55	$1570.21	$1177.66	$2500.00	$7845.83	$9308.33
$527.13	$1308.51	$981.38	$2500.00	$7845.83	$9308.33
$620.59	$1682.37	$1261.78	$2500.00	$7845.83	$9308.33
$717.17	$2068.69	$1551.52	$2500.00	$7845.83	$9308.33
$1134.65	$3738.60	$2803.95	$2500.00	$7845.83	$9308.33
$801.29	$2405.17	$1803.87	$2500.00	$7845.83	$9308.33
$813.75	$2455.01	$1841.26	$2500.00	$7845.83	$9308.33
$788.83	$2355.32	$1766.49	$2500.00	$7845.83	$9308.33
$657.98	$1831.91	$1373.94	$2500.00	$7845.83	$9308.33
$679.79	$1919.15	$1439.36	$2500.00	$7845.83	$9308.33
$670.44	$1881.76	$1411.32	$2500.00	$7845.83	$9308.33
$626.82	$1707.29	$1280.47	$2500.00	$7845.83	$9308.33
$8631.00	$24924.00	$18693.00	$30000.00	$94150.00	$111700.00
$719.25	$2077.00	$1557.75	$2500.00	$7845.83	$9308.33

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $500,000 Grant

Western Montana Total Cost Without Project Dollars/Month	Western Montana Total Cost With Project Dollars/Month	Western Montana Total Amount Saved With Project Dollars/Month	Beaverhead County Total Cost Without Project Dollars/Month	Beaverhead County Total Cost With Project Dollars/Month	Beaverhead County Total Amount Saved With Project Dollars/Month
$49264.21	$48953.92	$310.29	$8740.00	$4838.05	$3901.95
$44603.97	$45459.11	($855.15)	$8740.00	$4465.13	$4274.87
$39540.44	$38730.67	$809.76	$8740.00	$4997.88	$3742.12
$35104.25	$32574.08	$2530.17	$8740.00	$5548.39	$3191.61
$25783.77	$24229.63	$1554.13	$8740.00	$7928.01	$812.00
$22064.54	$22212.81	($148.28)	$8740.00	$6027.86	$2712.14
$17493.92	$22288.21	($4794.29)	$8740.00	$6098.89	$2641.11
$19062.27	$22137.42	($3075.15)	$8740.00	$5956.83	$2783.17
$22826.31	$21350.58	$1475.73	$8740.00	$5210.98	$3529.02
$27486.55	$25622.34	$1864.21	$8740.00	$5335.29	$3404.71
$40033.35	$38335.63	$1697.72	$8740.00	$5282.01	$3457.99
$48278.39	$47357.63	$920.76	$8740.00	$5033.39	$3706.61
$391541.93	$389252.04	$2289.89	$104880.00	$66722.70	$38157.30
$32628.49	$32437.67	$190.82	$8740.00	$5560.23	$3179.78

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a $500,000 Grant

Madison County Total Cost Without Project Dollars/Month	Madison County Total Cost With Project Dollars/Month	Madison County Total Amount Saved With Project Dollars/Month	Coalition Total Cost Without Project Dollars/Month	Coalition Total Cost With Project Dollars/Month	Coalition Total Amount Saved With Project Dollars/Month
$11208.33	$7845.83	$3362.50	$69212.54	$61637.80	$7574.74
$11208.33	$7845.83	$3362.50	$64552.30	$57770.07	$6782.23
$11208.33	$7845.83	$3362.50	$59488.77	$51574.38	$7914.39
$11208.33	$7845.83	$3362.50	$55052.58	$45968.30	$9084.28
$11208.33	$7845.83	$3362.50	$45732.10	$40003.47	$5728.63
$11208.33	$7845.83	$3362.50	$42012.87	$36086.51	$5926.36
$11208.33	$7845.83	$3362.50	$37442.25	$36232.94	$1209.31
$11208.33	$7845.83	$3362.50	$39010.60	$35940.08	$3070.52
$11208.33	$7845.83	$3362.50	$42774.64	$34407.39	$8367.25
$11208.33	$7845.83	$3362.50	$47434.88	$38803.46	$8631.42
$11208.33	$7845.83	$3362.50	$59981.68	$51463.48	$8518.20
$11208.33	$7845.83	$3362.50	$68226.72	$60236.86	$7989.86
$134500.00	$94150.00	$40350.00	$630921.93	$550124.74	$80797.19
$11208.33	$7845.83	$3362.50	$52576.83	$45843.73	$6733.10

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a Full Cost of Construction Grant ($1,500,000)

Input Vectors:

	Monthly Natural Gas Usage (Historical) in MCF per Month	Total Available Solid Waste in Tons per Year	Total Solid Waste to be Used in Tons per Year	Current Cost of a MCF of Natural Gas in Dollars per MCF	Solid Waste Removal From Campus of WMC in Dollars per Year
January	8340	8084	6231	4.481	2712
February	7300				
March	6170	Estimated Annual Cost	Estimated Annual Cost	Estimated Annual Cost	Estimated Annual Cost
April	5180	of Natural Gas Usage in	of Dumping of Ash in	of Electricity in	of Parts & Supplies in
May	3100	Dollars per MSW Ton	Dollars per MSW Ton	Dollars per MSW Ton	Dollars per MSW Ton
June	2270				
July	1250	1.20	1.70	1.00	4.00
August	1600				
September	2440				
October	3480				
November	6280				
December	8120				

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a Full Cost of Construction Grant ($1,500,000)

Solid Waste Removal From Campus After Project: $/Year	Current Cost of Labor to Operate Existing Facility: $/Year	Current Cost to Operate Beaverhead County Landfill: $/Year	Current Cost to Operate Madison County Landfill: $/Yr	Estimated Annual Debt Service for Project in Dollars per Year	Total Available Wood Waste in Tons per Year
0	140000	104880	134500	0	8000

Estimated Annual Cost of Other Expenses in Dollars per MSW Ton	Estimated Cost of Labor to Operate New/Both Facilities: $/Year	Cost to Operate Beaverhead Landfill After Project: $/Year	Cost to Operate Madison County Landfill After the Project: $/Year	Total Tipping Fees to be Collected With This Project: $/Year	Estimated Cost of Wood Waste in Dollars per Ton
3.00	110000	30000	94150	0	4.00

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a Full Cost of Construction Grant ($1,500,000)

Month of Year	Western Montana Natural Gas Usage Average Over Month MCF/Day	Western Montana Required Energy Average Over Month MMBtu/Day	Western Montana Required Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Available Solid Waste Average Over Month Tons/Day	Beaverhead/Madison Solid Waste Used Average Over Month Tons/Day
January	269.0	234.9	50.52	16.43	12.66
February	258.4	225.6	48.52	15.02	11.58
March	199.0	173.8	37.37	17.60	13.57
April	172.7	150.8	32.42	22.37	17.24
May	100.0	87.3	18.78	39.12	30.15
June	75.7	66.1	14.21	26.00	20.04
July	40.3	35.2	7.57	25.69	19.80
August	51.6	45.1	9.69	24.64	18.99
September	81.3	71.0	15.27	19.81	15.27
October	112.3	98.0	21.08	20.08	15.48
November	209.3	182.8	39.31	20.34	15.68
December	261.9	228.7	49.19	17.86	13.77
Total	1831.6	1599.3	343.94	264.96	204.23
Average	152.6	133.3	28.66	22.08	17.02

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a Full Cost of Construction Grant ($1,500,000)

Beaverhead/Madison Required Wood to Make up Difference	Western Montana Required Natural Gas Start up/Make up	Western Montana Natural Gas Cost Without Project	Western Montana Solid Waste Removal Cost Without Project	Beaverhead County Landfill Operations Cost Without Project	Madison County Landfill Operations Cost Without Project
Tons/Day	MCF/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
21.03	6354.6	$37371.54	$226.00	$8740.00	$11208.33
20.52	5645.5	$32711.30	$226.00	$8740.00	$11208.33
13.23	4042.8	$27647.77	$226.00	$8740.00	$11208.33
8.44	2564.3	$23211.58	$226.00	$8740.00	$11208.33
0.00	250.3	$13891.10	$226.00	$8740.00	$11208.33
0.00	161.0	$10171.87	$226.00	$8740.00	$11208.33
0.00	164.4	$5601.25	$226.00	$8740.00	$11208.33
0.00	157.7	$7169.60	$226.00	$8740.00	$11208.33
0.00	123.7	$10933.64	$226.00	$8740.00	$11208.33
3.11	1053.4	$15593.88	$226.00	$8740.00	$11208.33
13.13	3900.7	$28140.68	$226.00	$8740.00	$11208.33
19.68	5961.3	$36385.72	$226.00	$8740.00	$11208.33
99.14	30379.8	$248829.93	$2712.00	$104880.00	$134500.00
8.26	2531.6	$20735.83	$226.00	$8740.00	$11208.33

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a Full Cost of Construction Grant ($1,500,000)

Coalition Natural Gas Cost With Project	Western Montana Solid Waste Removal Cost With Project	Beaverhead County Dumping Solid Waste Tipping Fees	Coalition Dumping Ash All Cost Necessary	Western Montana Labor/Operation Cost Without Project	Coalition Labor/Operation Cost With Project
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$28475.03	$0.00	$0.00	$667.34	$11666.67	$9166.67
$25297.55	$0.00	$0.00	$556.12	$11666.67	$9166.67
$18115.80	$0.00	$0.00	$715.01	$11666.67	$9166.67
$11490.79	$0.00	$0.00	$879.19	$11666.67	$9166.67
$1121.58	$0.00	$0.00	$1588.91	$11666.67	$9166.67
$721.55	$0.00	$0.00	$1022.20	$11666.67	$9166.67
$736.50	$0.00	$0.00	$1043.38	$11666.67	$9166.67
$706.60	$0.00	$0.00	$1001.01	$11666.67	$9166.67
$554.38	$0.00	$0.00	$778.56	$11666.67	$9166.67
$4720.37	$0.00	$0.00	$815.64	$11666.67	$9166.67
$17479.00	$0.00	$0.00	$799.75	$11666.67	$9166.67
$26712.54	$0.00	$0.00	$725.60	$11666.67	$9166.67
$136131.69	$0.00	$0.00	$10592.70	$140000.00	$110000.00
$11344.31	$0.00	$0.00	$882.73	$11666.67	$9166.67

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a Full Cost of Construction Grant ($1,500,000)

Coalition Additional Electricity Cost With Project	Coalition Parts and Supplies Cost With Project	Coalition Other Annual Cost With Project	Beaverhead County Landfill Operations With Project	Madison County Landfill Operations With Project	Coalition Debt Services Average Over Year
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$592.55	$1570.21	$1177.66	$2500.00	$7845.83	$0.00
$527.13	$1308.51	$981.38	$2500.00	$7845.83	$0.00
$620.59	$1682.37	$1261.78	$2500.00	$7845.83	$0.00
$717.17	$2068.69	$1551.52	$2500.00	$7845.83	$0.00
$1134.65	$3738.60	$2803.95	$2500.00	$7845.83	$0.00
$801.29	$2405.17	$1803.87	$2500.00	$7845.83	$0.00
$813.75	$2455.01	$1841.26	$2500.00	$7845.83	$0.00
$788.83	$2355.32	$1766.49	$2500.00	$7845.83	$0.00
$657.98	$1831.91	$1373.94	$2500.00	$7845.83	$0.00
$679.79	$1919.15	$1439.36	$2500.00	$7845.83	$0.00
$670.44	$1881.76	$1411.32	$2500.00	$7845.83	$0.00
$626.82	$1707.29	$1280.47	$2500.00	$7845.83	$0.00
$8631.00	$24924.00	$18693.00	$30000.00	$94150.00	$0.00
$719.25	$2077.00	$1557.75	$2500.00	$7845.83	$0.00

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a Full Cost of Construction Grant ($1,500,000)

Western Montana	Western Montana	Western Montana	Beaverhead County	Beaverhead County	Beaverhead County
Total Cost Without Project	Total Cost With Project	Total Amount Saved With Project	Total Cost Without Project	Total Cost With Project	Total Amount Saved With Project
Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month	Dollars/Month
$49264.21	$39645.58	$9618.62	$8740.00	$4838.05	$3901.95
$44603.97	$36150.78	$8453.19	$8740.00	$4465.13	$4274.87
$39540.44	$29422.34	$10118.10	$8740.00	$4997.88	$3742.12
$35104.25	$23265.74	$11838.50	$8740.00	$5548.39	$3191.61
$25783.77	$14921.30	$10862.47	$8740.00	$7928.01	$812.00
$22064.54	$12904.48	$9160.06	$8740.00	$6027.86	$2712.14
$17493.92	$12979.88	$4514.04	$8740.00	$6098.89	$2641.11
$19062.27	$12829.09	$6233.18	$8740.00	$5956.83	$2783.17
$22826.31	$12042.25	$10784.06	$8740.00	$5210.98	$3529.02
$27486.55	$16314.01	$11172.54	$8740.00	$5335.29	$3404.71
$40033.35	$29027.30	$11006.05	$8740.00	$5282.01	$3457.99
$48278.39	$38049.30	$10229.09	$8740.00	$5033.39	$3706.61
$391541.93	$277552.04	$113989.89	$104880.00	$66722.70	$38157.30
$32628.49	$23129.34	$9499.16	$8740.00	$5560.23	$3179.78

Computer Simulation: Condition; Both Beaverhead and the Western Portion of Madison County With a Full Cost of Construction Grant ($1,500,000)

Madison County Total Cost Without Project Dollars/Month	Madison County Total Cost With Project Dollars/Month	Madison County Total Amount Saved With Project Dollars/Month	Coalition Total Cost Without Project Dollars/Month	Coalition Total Cost With Project Dollars/Month	Coalition Total Amount Saved With Project Dollars/Month
$11208.33	$7845.83	$3362.50	$69212.54	$52329.47	$16883.07
$11208.33	$7845.83	$3362.50	$64552.30	$48461.74	$16090.56
$11208.33	$7845.83	$3362.50	$59488.77	$42266.05	$17222.72
$11208.33	$7845.83	$3362.50	$55052.58	$36659.96	$18392.62
$11208.33	$7845.83	$3362.50	$45732.10	$30695.14	$15036.96
$11208.33	$7845.83	$3362.50	$42012.87	$26778.18	$15234.69
$11208.33	$7845.83	$3362.50	$37442.25	$26924.60	$10517.65
$11208.33	$7845.83	$3362.50	$39010.60	$26631.75	$12378.85
$11208.33	$7845.83	$3362.50	$42774.64	$25099.06	$17675.58
$11208.33	$7845.83	$3362.50	$47434.88	$29495.13	$17939.75
$11208.33	$7845.83	$3362.50	$59981.68	$42155.14	$17826.54
$11208.33	$7845.83	$3362.50	$68226.72	$50928.52	$17298.20
$134500.00	$94150.00	$40350.00	$630921.93	$438424.74	$192497.19
$11208.33	$7845.83	$3362.50	$52576.83	$36535.39	$16041.43

Appendix A

Computer Simulation Calculations

Appendix A

Computer Simulation Calculations

General Assumptions

Throughout the body of the report assumptions were made. On the whole they have been explained in the sections that they first appeared, however, the following are important enough to discuss again or were overlooked earlier.

The Btu content of several materials is important to many energy calculations. In that it is difficult to specifically calculate such a figure average "acceptable" numbers were used. For a MCF of Natural Gas, in the Dillon area, the Btu content has been assumed to be 873,171 Btu/MCF. This is based on Montana Power Company calculations.

Steam is the heating median used throughout the campus and is what will be produced by the burning of municipal solid waste. A range of Btu/lb of steam figures exist. 930 Btu/lb of steam has been used in this report.

The energy content of municipal solid waste and wood waste, is extremely difficult to determine. Particularly since the day-to-day characteristics fluctuate. The figure 5,000 pounds of steam per ton of municipal waste burned has been used. This equals a figure of 2,325 Btu/lb of MSW (4.65 MMBtu/Ton). Wood waste averages are higher; 9,000 pounds of steam per ton of wood waste burned has been used. In Btu content this equals 4,185 Btu/lb of wood waste (8.37 MMBtu/Ton).

At the time this report was begun, Western Montana College was paying Montana Power Company $4.481/MCF of natural gas; this figure has been used throughout the report except for the cost projections on page 32.

Volume of waste figures, for the sites listed, are based on estimates by the county sanitarians and historical records. MSW from West Yellowstone and Yellowstone National Park has not been used for calculation purposes. Figures containing this waste should indicate such.

The equipment necessary to produce electricity proved costly. In investigating the current cost of electricity versus the cost of equipment it was determined that the cost of a kilowatt-hour would have to rise above $0.09/KWH for the generation of electricity to be cost effective. Montana Power Company projections estimate such cost unlikely in the next ten years. Facility equipment cost estimates did not consider any electrical generation equipment.

Simulation Calculations

The following formuals are those used to calculate the results in the printouts presented earlier in this report. Each simulation has 35 rows of calculated data, each row is divided into 14 columns, representing the 12

months of the year and a "Total" and "Average" column.

This description begins at "Natural Gas Usage Average Over Month" and reading to the right finishes with "Total Amount Saved With Project." Each monthly calculation is the same as those indicated here except where seasonal variable figures have been noted. All entries in a formuala with "Input" before them indicate that they are input vetors and have been calculated elsewhere in this report.

1. Historic MCF/Day = (Input MCF/Month)/(Days/Month)

MCF/Month is an input vector. The figures are based on historical natural gas comsumption at Western Montana College.

2. Historic MMBtu/Day = (MCF/Day) * 0.873171 (MMBtu/MCF)

3. Required MSW Tons/Day = (MMBtu/Day)/(0.00093/5000)

4. Available MSW Tons/Day = ((Input Tons Available) * (Season Adjustment))/(Days/Month)

For the seasonal adjustments referred to and used see Table 2-4, Estimated Monthly Percentage of Annual MSW Available, on page 7.

5. Used MSW Tons/Day = ((Input Tons Used) * (Season Adjustment))/(Days/Month)

For the seasonal adjustment referred to and used see Table 2-4, Estimated Monthly Percentage of Annual MSW Available, on page 7.

6. Required Wood Tons/Day = IF (Required MSW Tons/Day) - (Used MSW Tons/Day) is greater than zero

This calculation is a computer "if statement". One of two results is possible, if the statement is true this calculation is carried out, (Required MSW Tons/Day) - (Used MSW Tons/Day) * (5000/9000). If the statement is false no calculation will be carried out and the printout will read zero.

7. Required MCF/Month With Project = IF (MCF/Day) * 0.873171) - (Used MSW Tons/Day) * 5000/0.00093 is less than zero

This calculation is a computer "if statement". One of two results is possible, if the statement is true this calculation is carried out, (Used MSW Tons/Day) * (Input $ Gas/Ton) * (Days/Month). If the statement is false the calculation ((Used MSW Ton/Day) * (Input $ Gas/Ton)/($/MCF)) + ((MCF/Day) - ((Used MSW Tons/Day) * 5000/.00093/0.873171)) * (Days/Month) is carried out.

8. Gas Without Project Dollars/Month = (MCF/Day) * ($/MCF) * (Days/Month)

9. WMC Trash Removal Without Project Dollars/Month = (Input Annual Cost)/12

10. Beaverhead Landfill Dollars/Month = (Input Annual Cost)/12

11. Madison Landfill Dollars/Month = (Input Annual Cost)/12

12. Gas With Project Dollars/Month = (MCF/Month) * ($/MCF)

13. WMC Trash Removal With Project Dollars/Month = (Input Annual Cost)/12

14. Tipping Fees Dollars/Month = (Input Annual Cost)/12

This is not a expense but an asset. A tipping fee is simply the "price of admittance" to use a landfill or dump site. At present no such fees are charged in Beaverhead County, nor have calculations been prepared assuming the MSW Recovery Station would charge such fees.

15. Ash Removal Dollars/Month = (Used MSW Tons/Day) * (Input $/Ton) * (Days/Month)

16. WMC Labor Without Project Dollars/Month = (Input Annual Cost)/12

17. WMC Labor With Project Dollars/Month = (Input Annual Cost)/12

18. Electrical Dollars/Month = IF (Used MSW Tons/Day) * (Input $/Ton) * (Day/Month) + 200 is greater than 201

If this statement is true the following calculation shall be carried out, (Used MSW Tons/Day) * (Input $/Ton) * (Day/Month) + 200. If the statement is false the printout will read zero, no calculation being carried out.

The figure 200 used here is an assumed base electrical load of $200 per month to maintain the facility.

19. Parts Dollar/Month = (Used MSW Tons/Day) * (Input $/Ton) * (Day/Month)

20. "Others" Dollars/Month = (Used MSW Tons/Day) * (Input $/Ton) * (Day/Month)

21. Beaverhead Landfill With Project Dollars/Month = (Input Annual Cost)/12

22. Madison Landfill With Project Dollars/Month = (Input Annual Cost)/12

23. Debt Service Dollars/Month = (Input Annual Cost)/12

24. WMC Existing Cost Dollars/Month = (Labor) + (Trash Removal) + (Natural Gas)

25. WMC With Project Dollars/Month = (Debt Service) + (0.5 "Others") + (0.5 Parts) + (0.5 Electrical) + (Labor) + (0.5 Ash) + (Trash Removal) + (Natural Gas)

For the purposes of this report it was assumed that Western Montana College and Beaverhead County would split the cost of most all facility operations and maintenance costs.

26. WMC Loss/Savings Dollars/Month = (WMC Existing Cost) - (WMC With Project)

27. Beaverhead Existing Cost Dollars/Month = (Input Annual Landfill Cost)/12

28. Beaverhead With Project Dollars/Month = (0.5 "Others") + (0.5 Parts) + (0.5 Electrical) + (0.5 Ash) + (Landfill) - (Annual Tipping Fees)

29. Beaverhead Loss/Savings Dollars/Month = (Beaverhead Existing Cost) - (Beaverhead With Project)

30. Madison Existing Cost Dollars/Month = (Input Annual Landfill Cost)/12

31. Madison With Project Dollars/Month = (Input Annual Cost)/12

32. Madison Loss/Savings Dollars/Month = (Madison Existing Cost) - (Madison With Project)

33. Total Existing Situation Dollars/Month = (WMC Existing Cost) + (Beaverhead Existing Cost) + (Madison Existing Cost)

34. Total With Project Dollars/Month = (WMC With Project) + (Beaverhead With Project) + (Madison With Project)

35. Total Loss/Saving Situation Dollars/Month = (Total Existing Situation) - (Total With Project)

Seven different scenarios, of this simulation are included in this report; all are presented in section eight. Page 63 presents the "bottom line" savings or loss of each of the scenarios.

These scenarios can be used to provide current information simply by updating and reentering the input data described in section eight.

Appendix B

Sample Specifications and Product Literature

Appendix B

Sample Specifications and Product Literature

Sample Specifications and Product Literature

Of the incinerator systems and system manufacturers reviewed in section five, Mass Burner Systems (page 33) the modular system produced by Consumat Systems, Incorporated of Richmond, Virginia has been recommended for this project. This appendix presents a brief booklet on the company, and the equipment it produces. For further details on the equipment or a version of the process described in this report, contact Matney Frantz Engineering (406) 586 3748 or Widjac Corporation (206) 828 6551.

The modular system necessary for Western Montana College will be required to have the capability of processing approximately 20 tons of waste every day, assuming the implementation of the Beaverhead and western portion of Madison County scenario. Assuming operations of 24 hours a day, seven days a week, such a volume of waste would require a hourly processing rate of 1,667 pounds of waste materials.

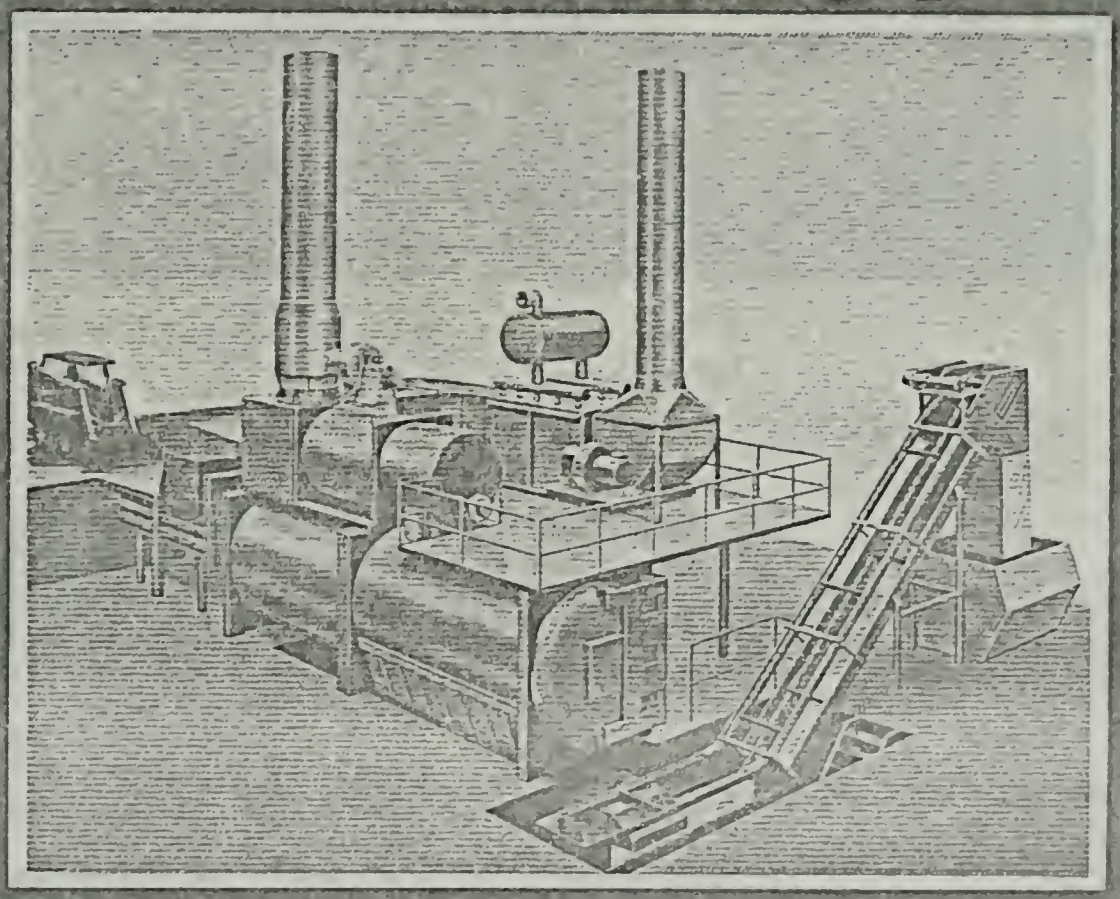
In the following product literature, pages 10, 11, and 12 contain specifications and diagrams of three incinerator and energy heat exchangers which are within the usable range. The CS-800 WITH ENERGY is capable of processing 1,250 pounds of waste every hour, or approximately 15 tons per day. The CS-1000 WITH ENERGY and the CS-1200 WITH ENERGY process 1,650 lb/hour and 2,100 lb/hour respectively, or 19.8 and 25.2 tons per day.

A review of the solid waste usage over the year, with the Beaverhead and western Madison County scenario, indicates an average consumption of 17.02 tons per day. The range of daily consumption is as low as 11.58 tons per day in February and as high as 30.15 tons per day in May. Seven months of the year the tons/day figure is 16 or less and is below 21, 11 months of the year. This review indicates that the CS-800 would be overworked on a daily basis and leave little room for future increases in municipal solid waste.

Implementation of the CS-1000 seems to be the best choice at this time. Its capability of 19.8 tons/day would allow it to operate, on an annual basis, at 85 percent. This allows the incinerator and supporting equipment to easily handle the requirements of most months and yet not be over strained in the months of increased volume. As well, there is some room for future increase in waste volumes.

The CS-1200 appears to be large enough to handle the expected volumes of waste with only the month of May projecting a daily volume larger than its capabilities. On an annual average the CS-1200 would work at 66 percent capabilty, a figure which suggests oversizing.

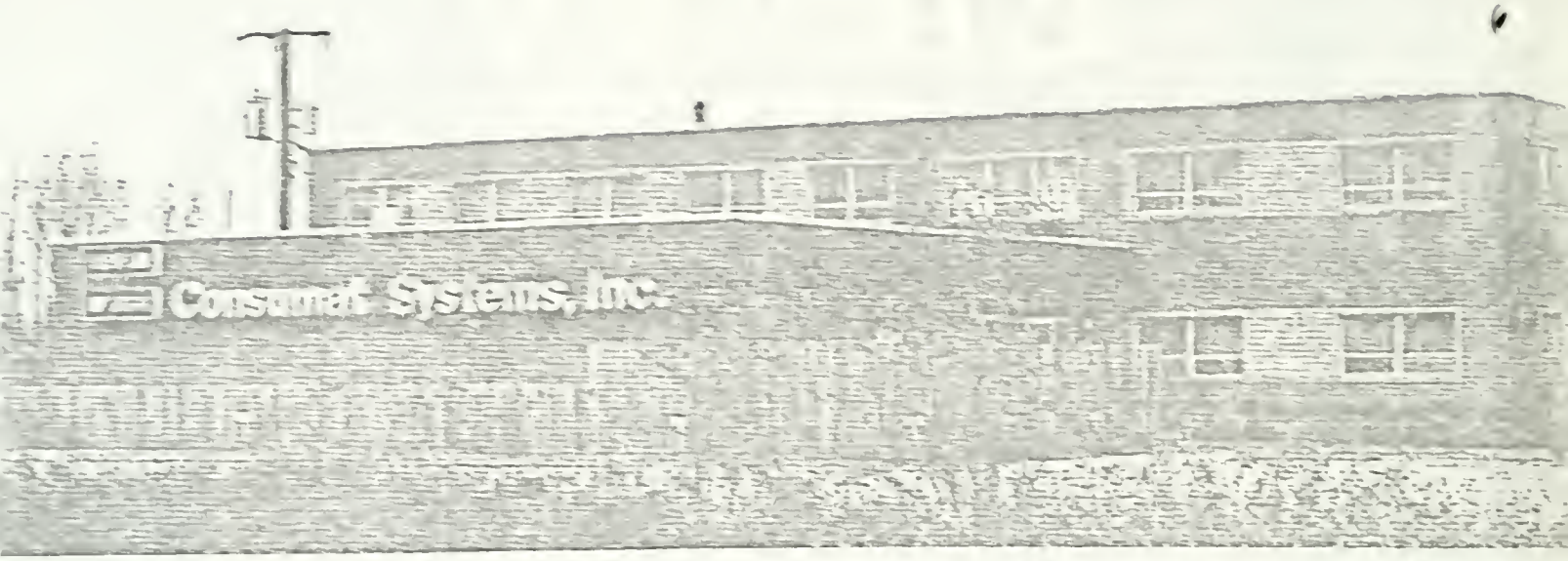
Energy from Waste



Modular Systems

Municipal and Industrial

Consumat Systems, Inc.
P.O. BOX 9379 • RICHMOND, VIRGINIA 23227



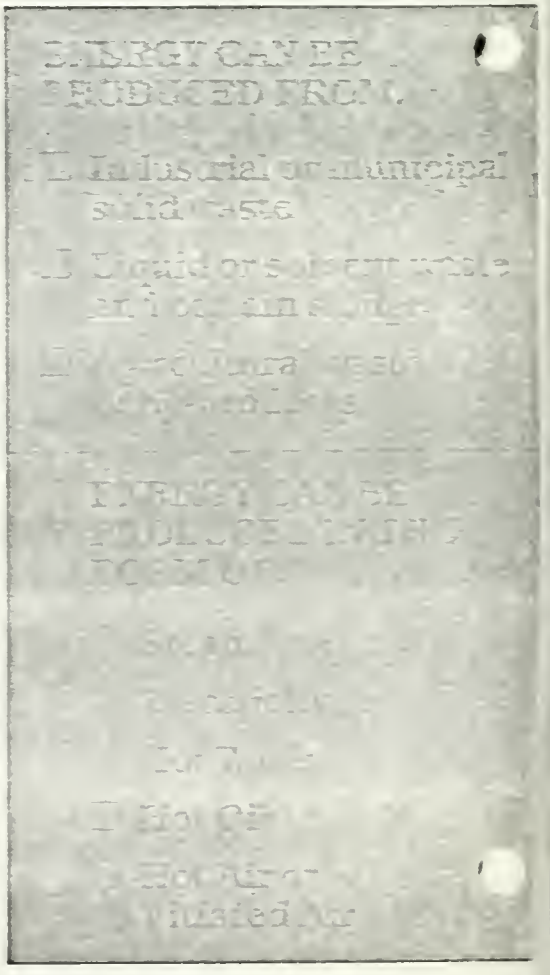
Consumat Systems, Inc.

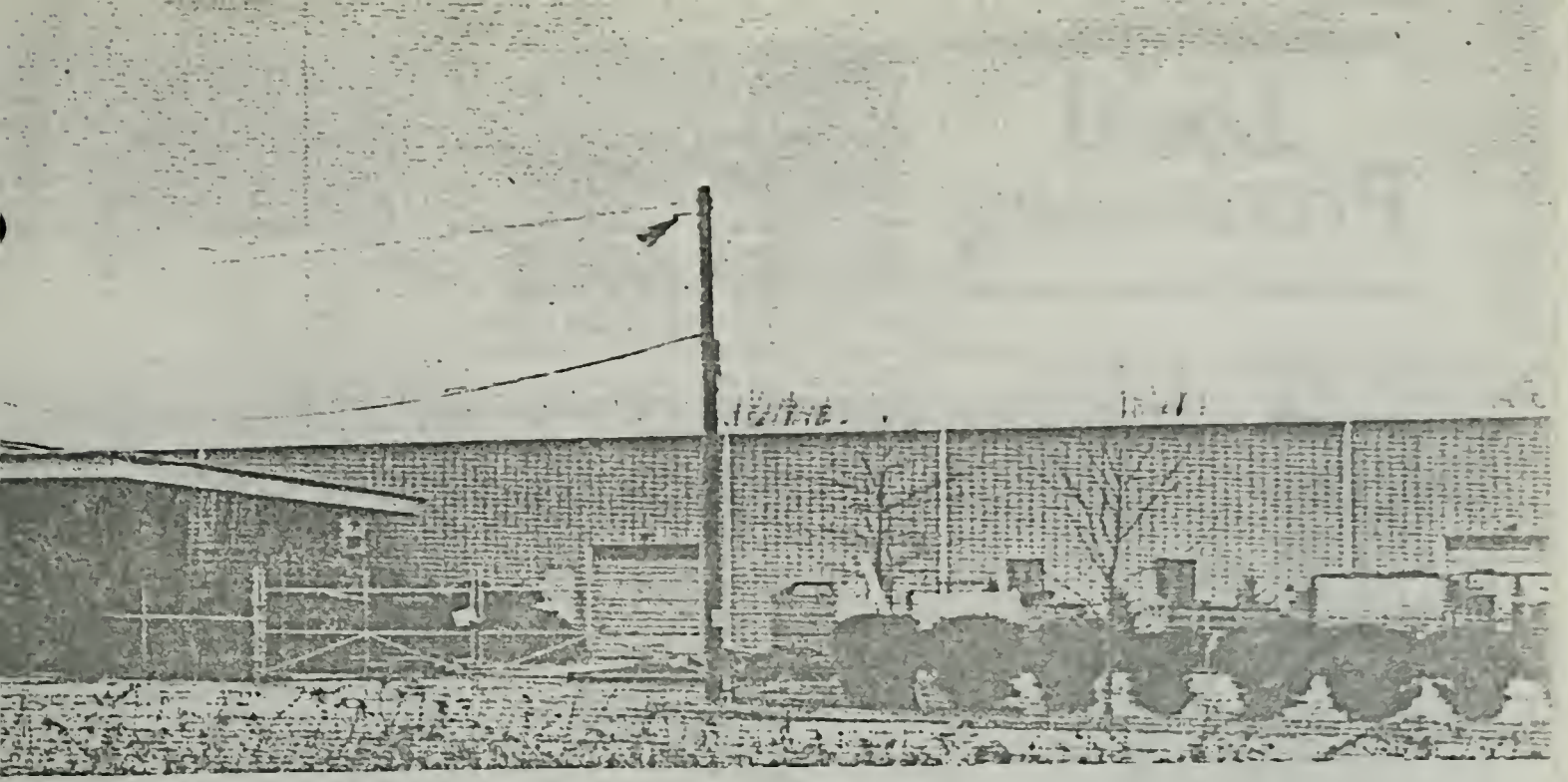
Products

Our primary product is energy—generated from what might otherwise be considered waste material.

We are the most experienced and successful company in our field. Our system affords a cost effective, environmentally sound method for producing energy from waste.

Our standard systems are capable of processing up to 500 tons of waste per day. A combination of standard modules can be arranged to process even larger quantities.





Our goal is to help industries and municipalities meet their energy needs in an economical and ecologically sound manner. A decade of experience has convinced us that our objectives are best met by adhering to the following seven basic principles:

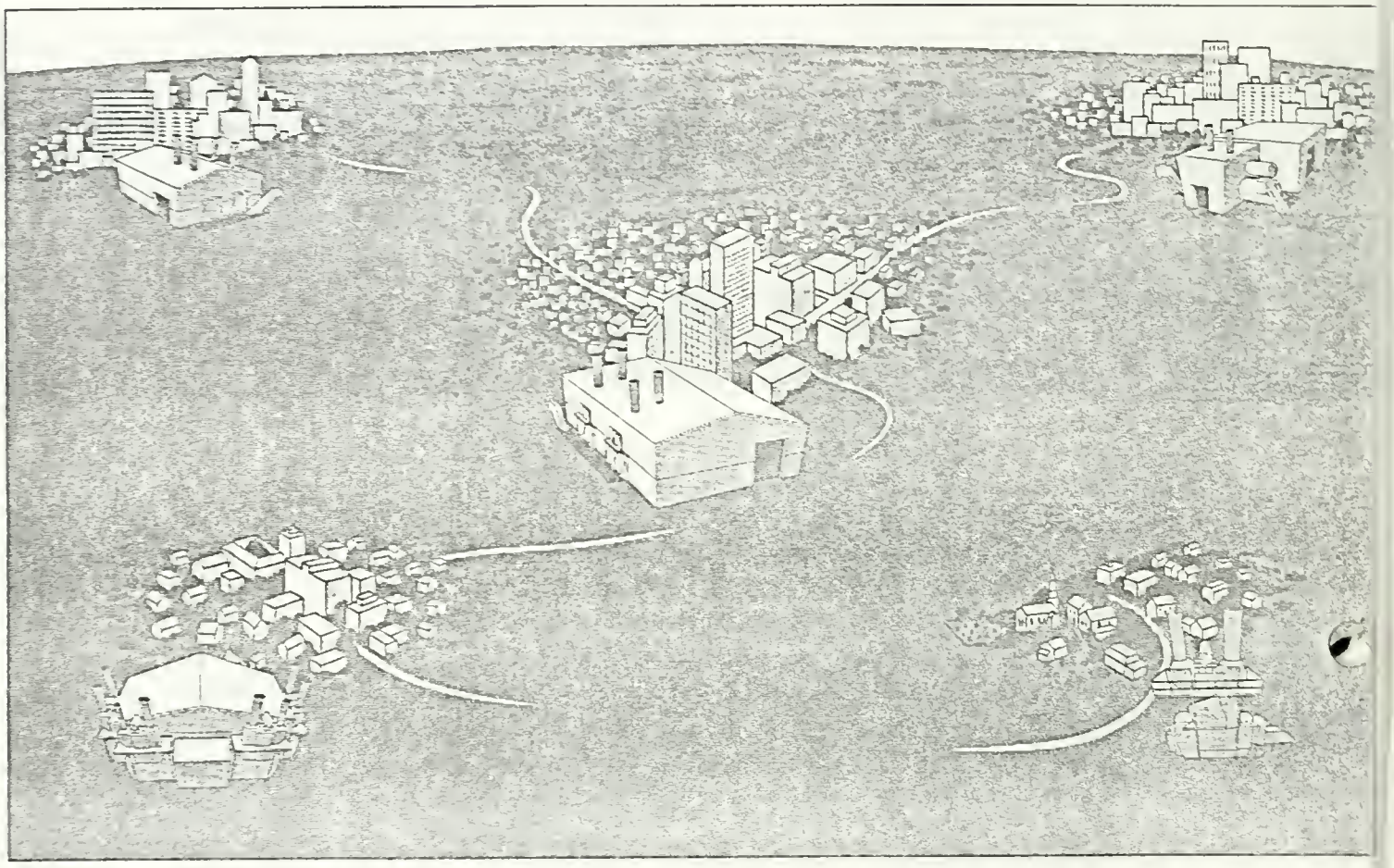
- ☐ Local Waste Processing and Energy Consumption
- ☐ Capacity for Processing Unprepared Waste
- ☐ Starved Air Technology
- ☐ Modular Design
- ☐ Pre-Engineered Components
- ☐ Factory Fabrication
- ☐ Full Service Capability

The information contained in this bulletin is intended as a general aid in the evaluation of systems which produce energy from waste. Information is included for both industrial and municipal applications. In addition to general information, Consumat Systems can provide detailed data and performance guarantees for specific systems.

Our engineering department is ready to aid in your system planning and we urge you to contact Consumat Systems in the early planning stages to take advantage of our extensive experience.

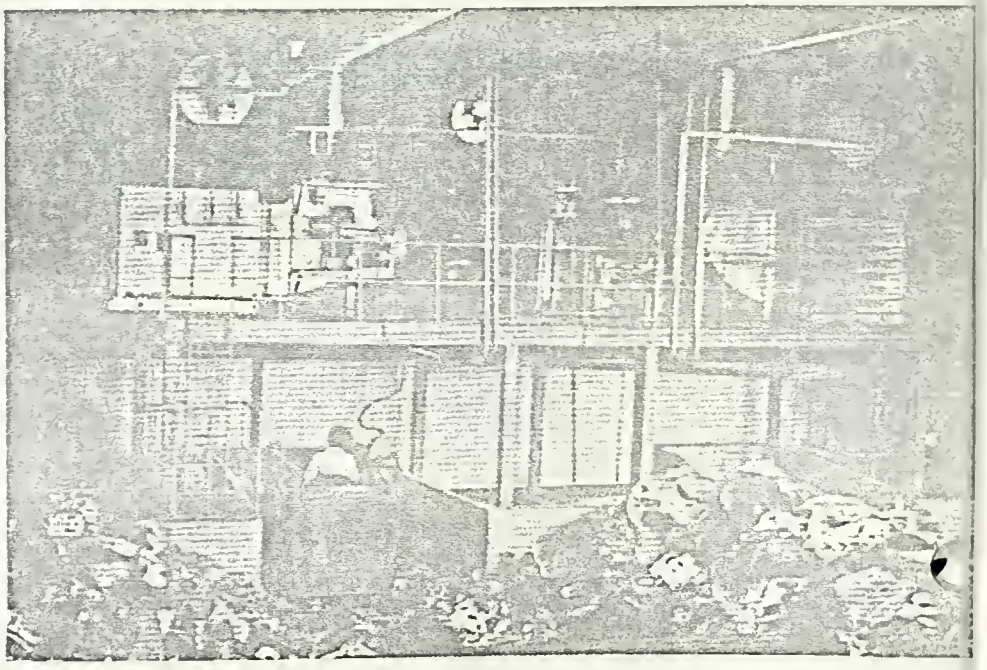
Local Processing

Until the development of the CONSUMAT® modular approach, it was assumed by many that the only economical way to extract and market energy-from-waste was through the operation and construction of large regional processing facilities. Now CONSUMAT® modules are demonstrating that waste can be more cost effectively processed into energy in smaller communities, industries and satellite locations within large metropolitan areas. The savings and overall systems energy effectiveness is due directly to the CONSUMAT® approach.



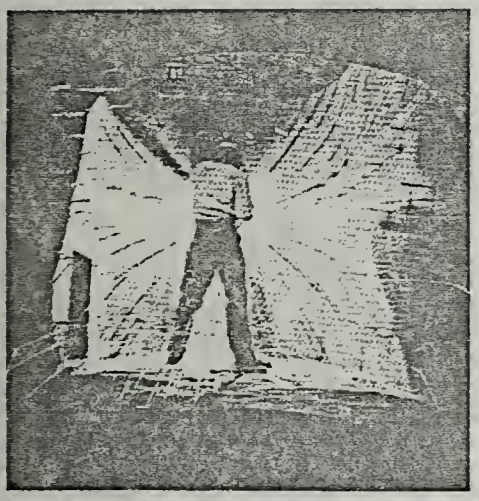
Capacity for processing Unprepared Waste

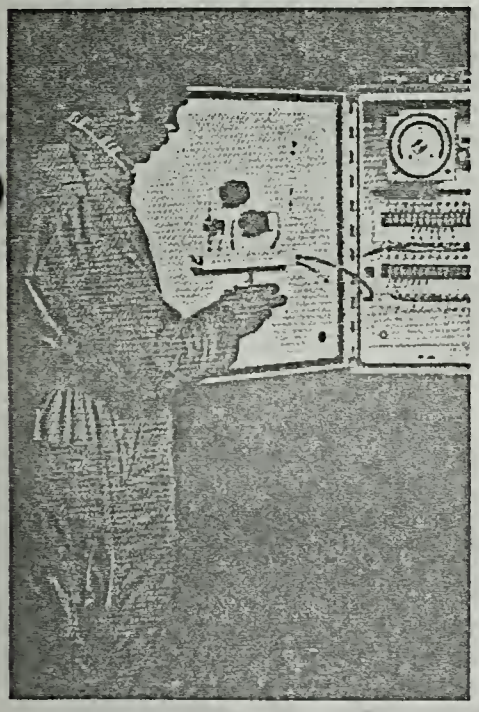
All CONSUMAT® processing plants are designed and developed to accept unprepared municipal waste, typically as received in a packer truck. This allows waste to be processed and energy to be generated at the lowest initial capital cost. For those areas where the recovery of materials is practical and economically viable, the CONSUMAT® systems can be equipped for materials recovery either during initial construction or at a later date.

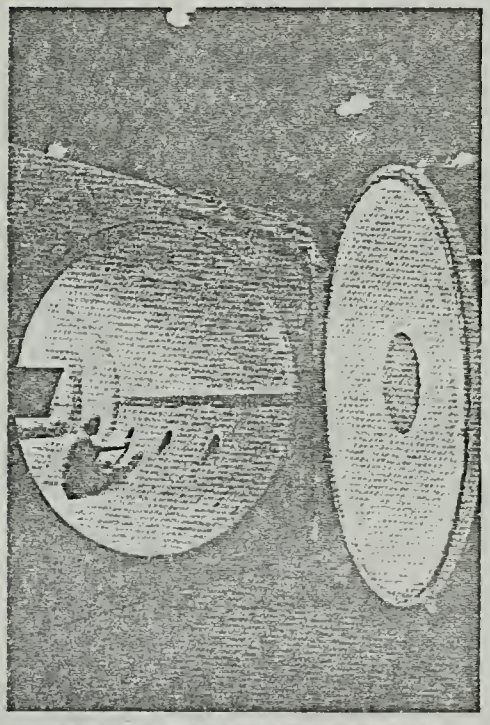


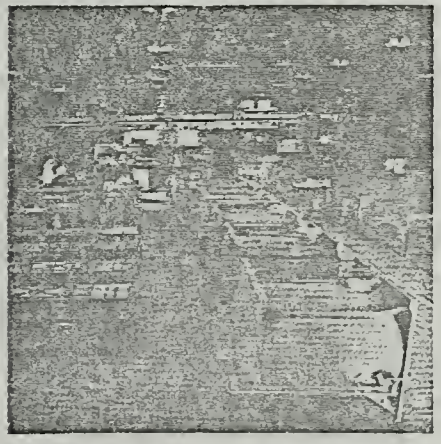
Factory Fabrication

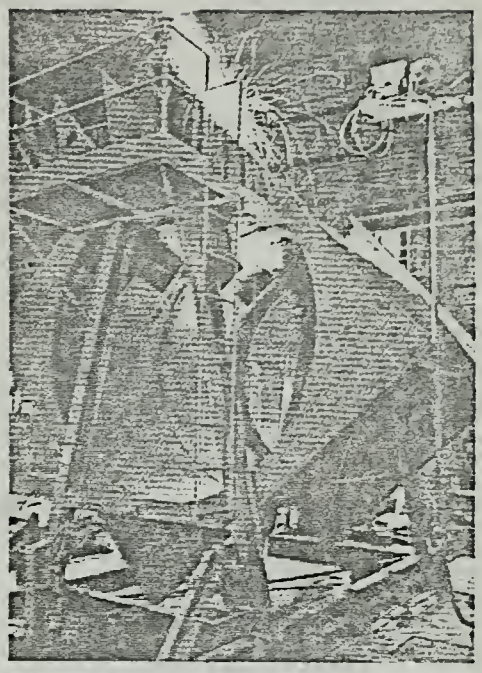
Factory fabrication is a major contributor to the superior economics of our energy systems. All systems are designed and fabricated under controlled conditions by experienced personnel in well equipped facilities. The pre-engineered modules are, thereby, reliably produced at a minimum cost. Entire assemblies are constructed, assembled, wired, plumbed and pre-checked within the controlled environment of the CONSUMAT® factory. A minimum of on-site assembly is necessary.

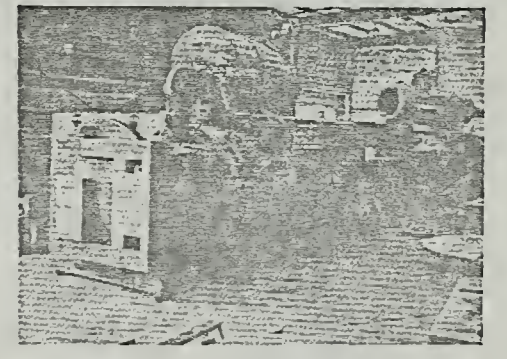












Starved Air Technology

The CONSUMAT* thermal reduction process is based on starved air combustion technology. A most important consideration is the fundamental ability of this process to control air emissions. No other thermal process can surpass a good starved air design for this purpose. In addition, the technology has been shown to offer a great range of flexibility in handling a wide variety of materials with varying energy and moisture contents.

Modular Design

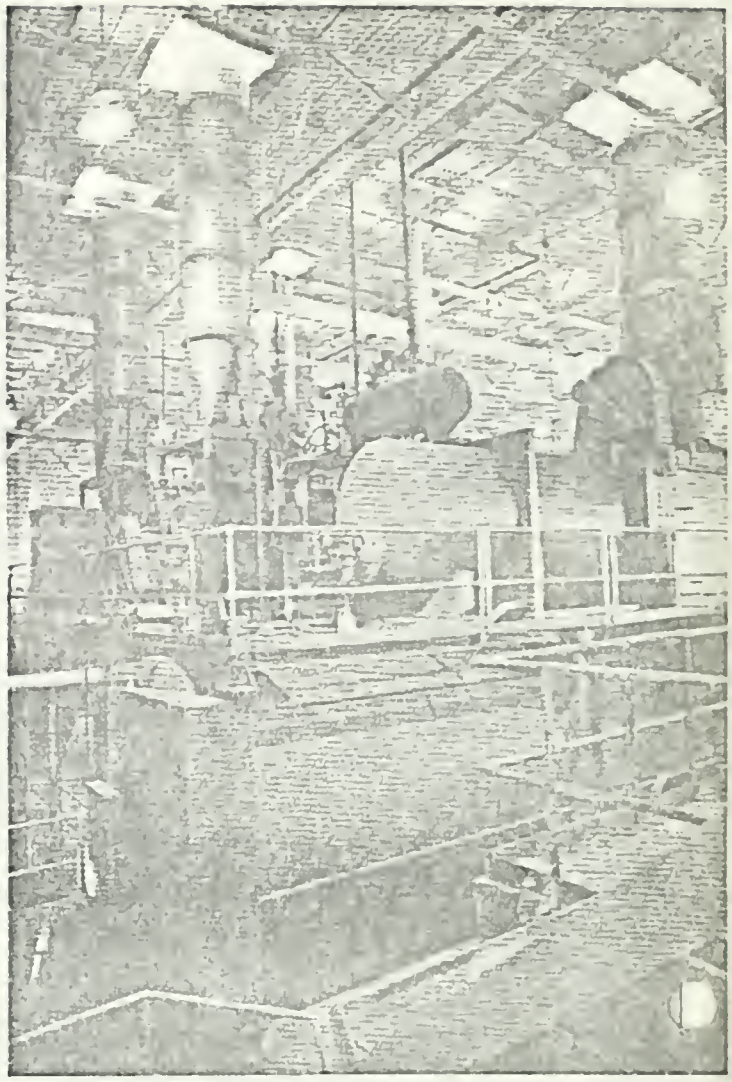
Consumat Systems' energy systems are fabricated by the selected assembly of standard design modules. This approach utilizes standard components to minimize risks and maximize economy. An additional attribute lies in the ability of this method to provide inexpensive system redundancy.

Pre-Engineered Components

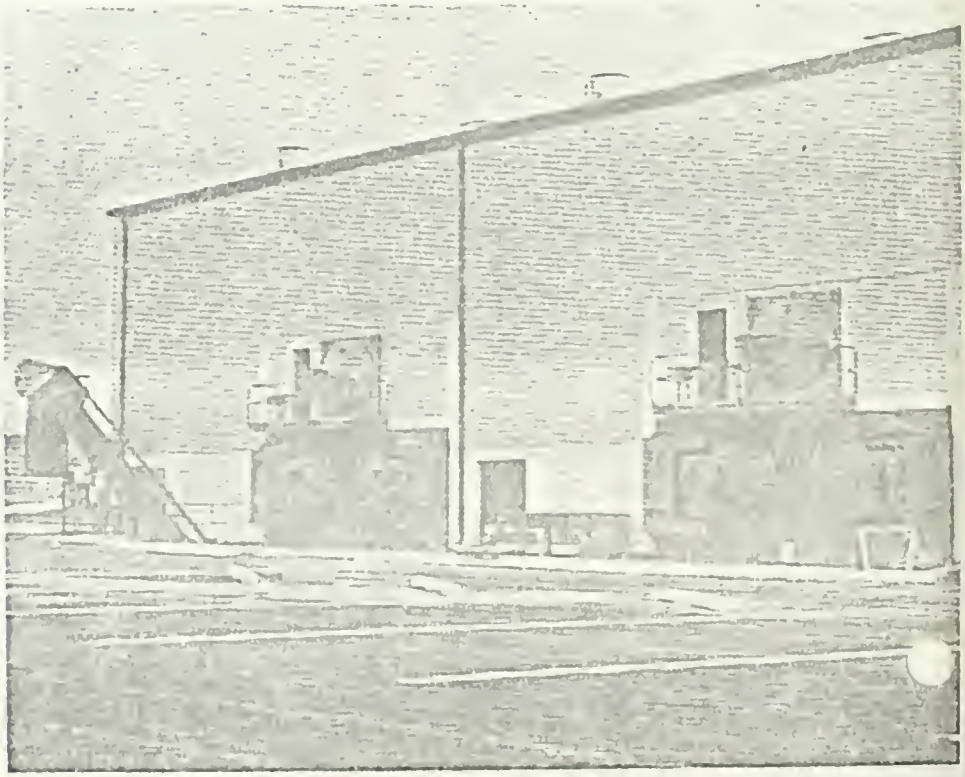
CONSUMAT* modules are all pre-engineered, their development has progressed through our years of experience in the field of starved air combustion. Known performance and reliability are assured.

Full Service Capability

Consumat Systems provides a full service capability for energy from waste systems. Our minimum participation includes all equipment design, construction, installation supervision and operator training. We also provide complete turn-key facilities and operating contracts. Under certain conditions financing can be provided for private ownership.



Typical Industrial Facility with 100 TPD installed capacity.



Typical Municipal Facility with 100 TPD installed capacity.

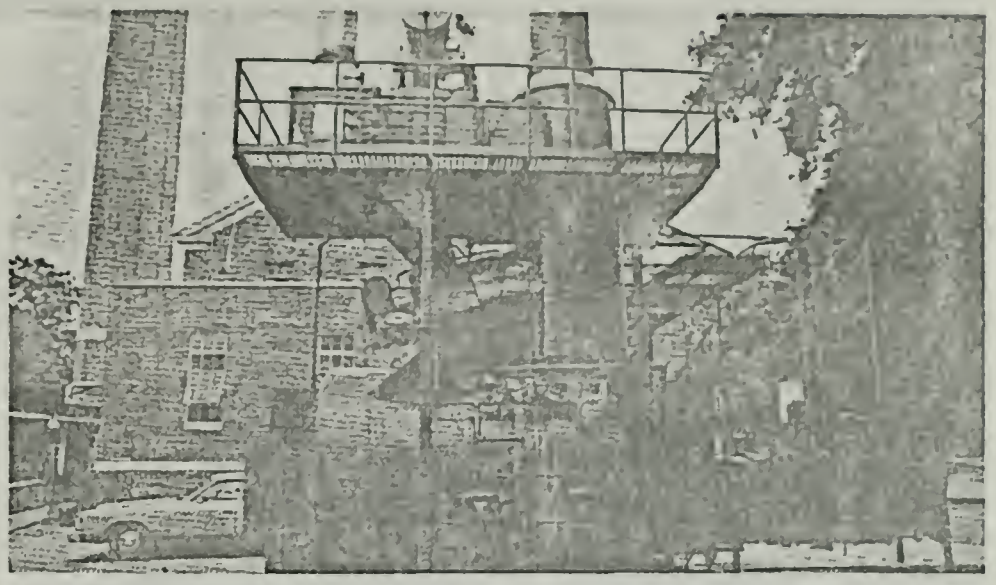
The Consumat Experience

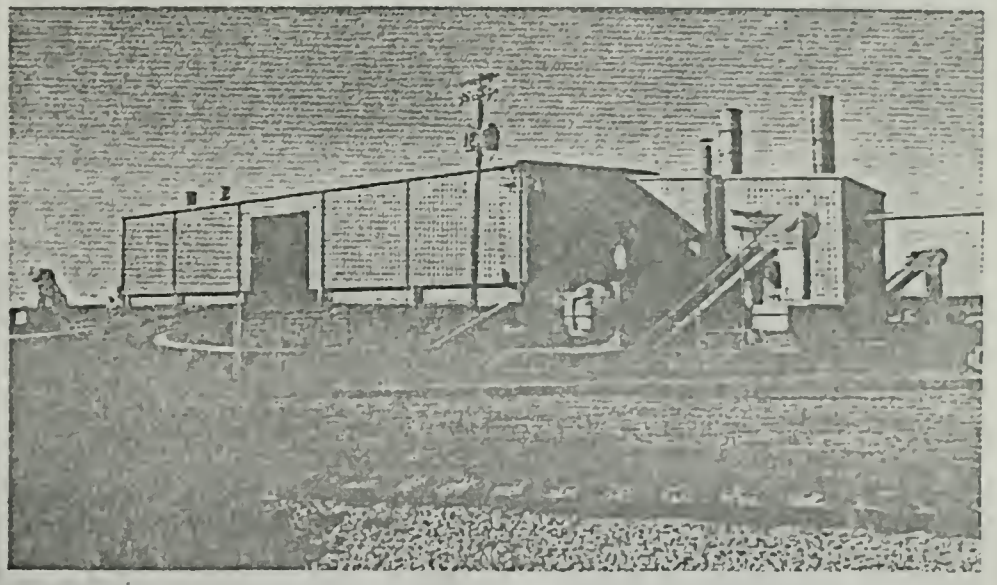
Consumat Systems, Inc. (CSI) began its energy recovery program in 1971. We recognized from the beginning that the recovery of energy from waste materials is a very specialized business. Our equipment has been designed since its inception from a total systems concept and all components have been developed specifically for a particular function. We believe Consumat Systems is the only company with this specific approach and with extensive experience in both municipal and industrial waste processing.

We began manufacturing non-polluting starved air incineration systems in 1966. Since that time we have constructed more than 3500 systems with installations in all 50 states and 34 foreign countries. Most of the latest systems are equipped to recover energy.

We were well into our third generation of system development prior to the beginning of the energy crisis. We have built on that experience and extended our expertise into the energy recovery field.

With the passage of the Clean Air Act Amendments of 1970, demand for our systems expanded rapidly and larger sizes were developed to accommodate the municipal and industrial markets. The following list traces the significant development events in the evolution of CONSUMAT® energy-from-waste systems.





1966
The first CSI starved air system was put into service.

1971
CSI's anticipation of the fossil fuel supply shortage led to design studies for steam production systems.

1973
The first prototype waste-to-energy system installation was made in a hospital.

1974
A prototype of the first CSI machine capable of continuous operation was installed.

1975
The first municipal system with energy recovery was installed.

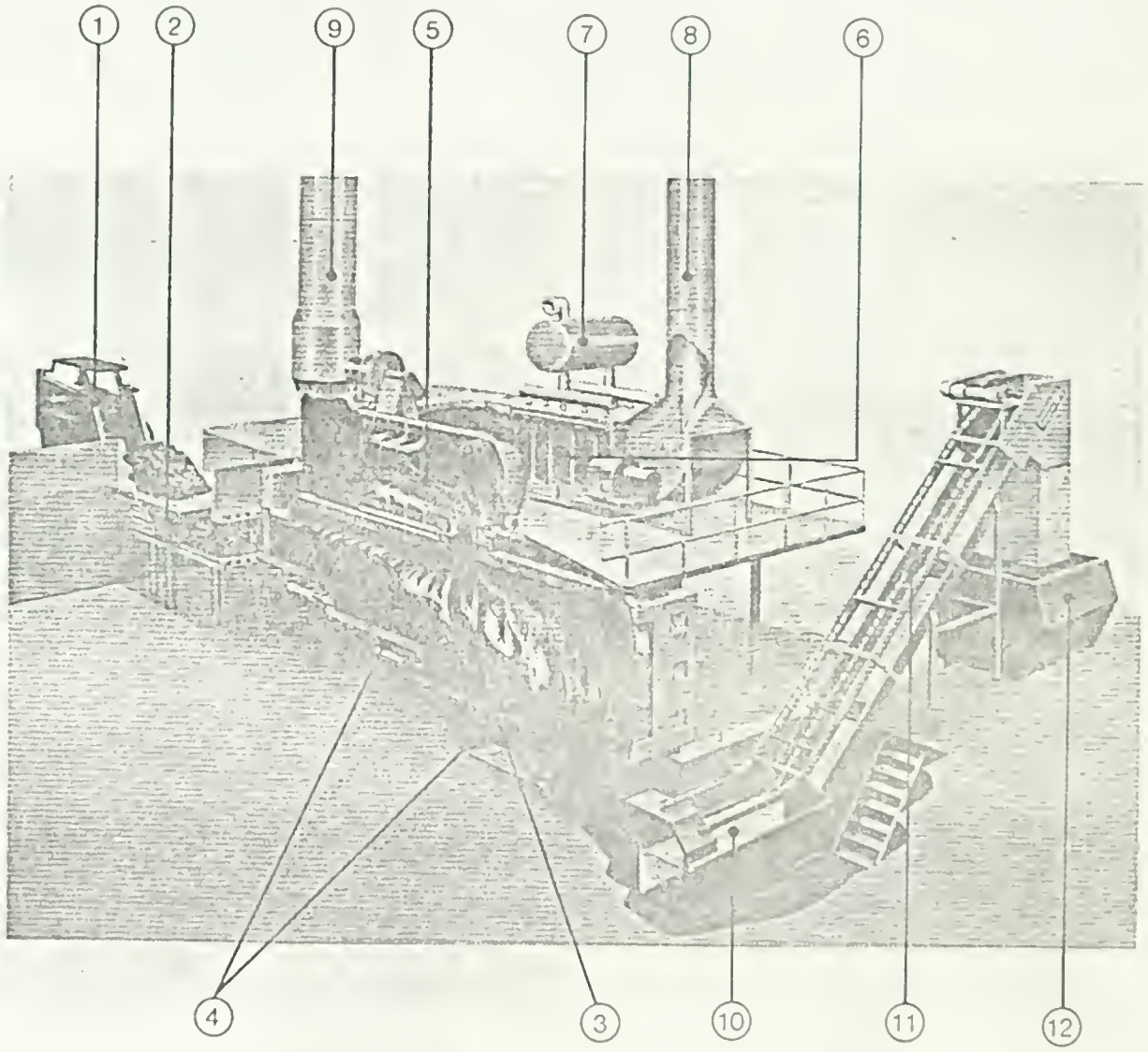
1976
The first installation of a continuous duty design was installed with energy recovery.

1977
CSI installed its first continuous duty municipal system to produce steam.

1978
The installation of the first industrial system capable of continuously processing 100 tons per day was completed.

The Standard Consumat® Module

The drawing below shows the standard CONSUMAT ® arrangement for single processing modules. The loading arrangement is typical in municipal and large industrial applications. Other loading options available include such CONSUMAT ® standards as automatic cart dump, pneumatic, conveyor belt, and direct dumpster discharge systems. CONSUMAT ® factory engineers can supply you with details to match your specific installation requirements.



The above cutaway view of the standard CONSUMAT ® energy-from-waste module shows how material and hot gas flows are controlled to provide steam from solid waste. A skid steer tractor (1) pushes the waste to the automatic loader (2). The loader then automatically injects the waste into the gas production chamber (3) where transfer rams (4) move the material slowly through the system. The high temperature environment in the gas production chamber is provided with a controlled quantity of air so that gases from the process are not burned in this chamber but fed to the upper or pollution control chamber (5). Here the gases are mixed with air and controlled to maintain a proper air fuel ratio and temperature for entrance into the heat exchanger (6) where steam is produced. A steam separator (7) is provided to ensure high quality steam. In normal operation gases are discharged through the energy stack (8). When steam is not required or in the event of a power failure, hot gases are vented through the dump stack (9). The inert material from the combustion process is ejected from the machine in the form of ash into the wet sump (10) and conveyed (11) into a closed bottom container (12) which can then be hauled to the landfill for final disposal.

Standard Modular Combinations

A number of standard combinations of the single modules have been developed which give overall systems reliability in excess of that of the individual components. Three such systems are shown on this page.

Standard CONSUMAT® processing modules are designed so that almost any routine repair can be made while the system is in operation. This is done by designing all components such as electric motors, switches, hydraulics, etc. for accessibility from the outside of the machine.

Dual System

Two processing chambers can be combined with a single oxidizing chamber feeding a single energy system to provide better system flexibility. This combination provides the same overall capacity as two single modules but at a reduced capital cost. In addition, the dual system has the effect of smoothing the mass flow from the processing chambers to the energy systems. Either one or both modules can be operated while maintaining good overall efficiency.

Tri-Pac

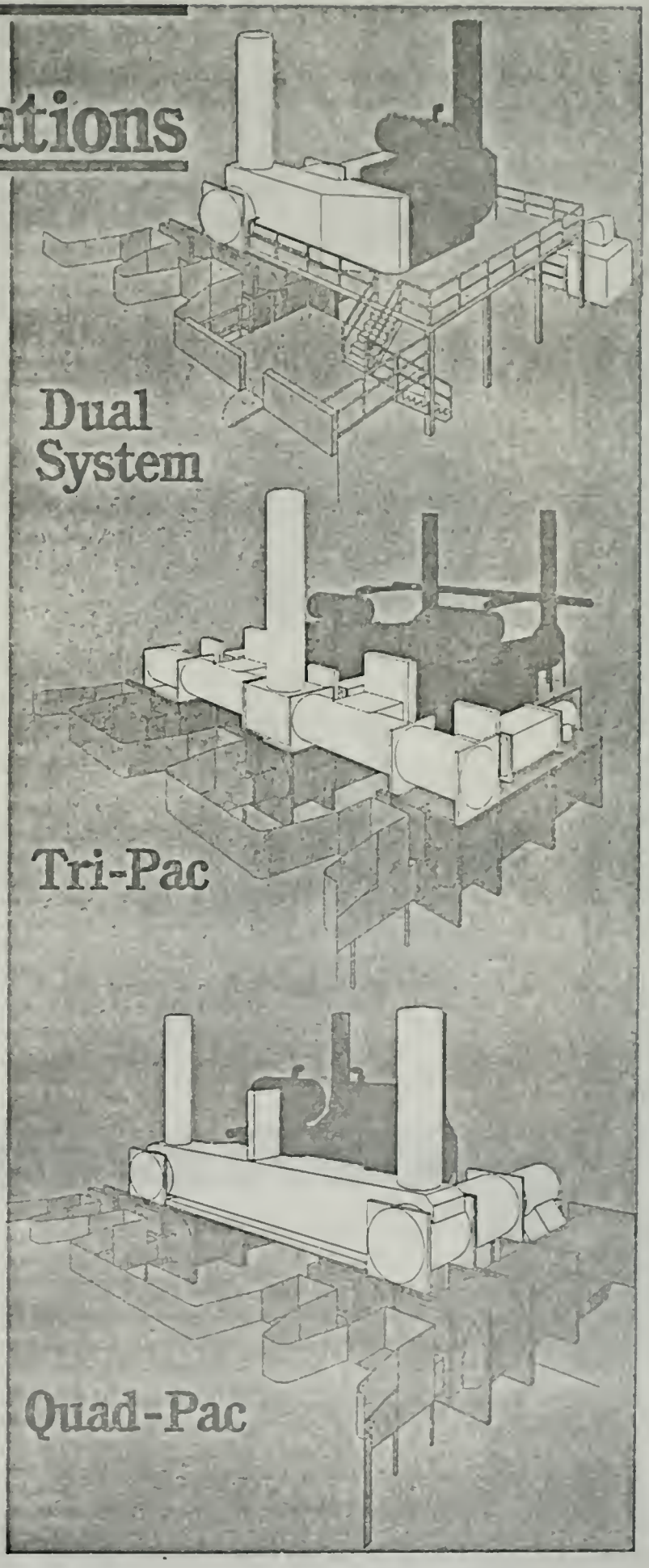
The standard Tri-Pac system includes three processing modules, three oxidizing chambers and two energy systems. In addition to the advantages found in the Dual system, the Tri-Pac can be used to provide inexpensive system redundancy. A spare processing chamber is available for either routine maintenance or to provide flexibility for varying seasonal loads. Manifolding of the gases from the oxidizing chamber allows the Tri-Pac system to feed gas from any processing chamber to any energy module. When all three modules are used, a very smooth gas flow for energy production is provided.

Quad Pac

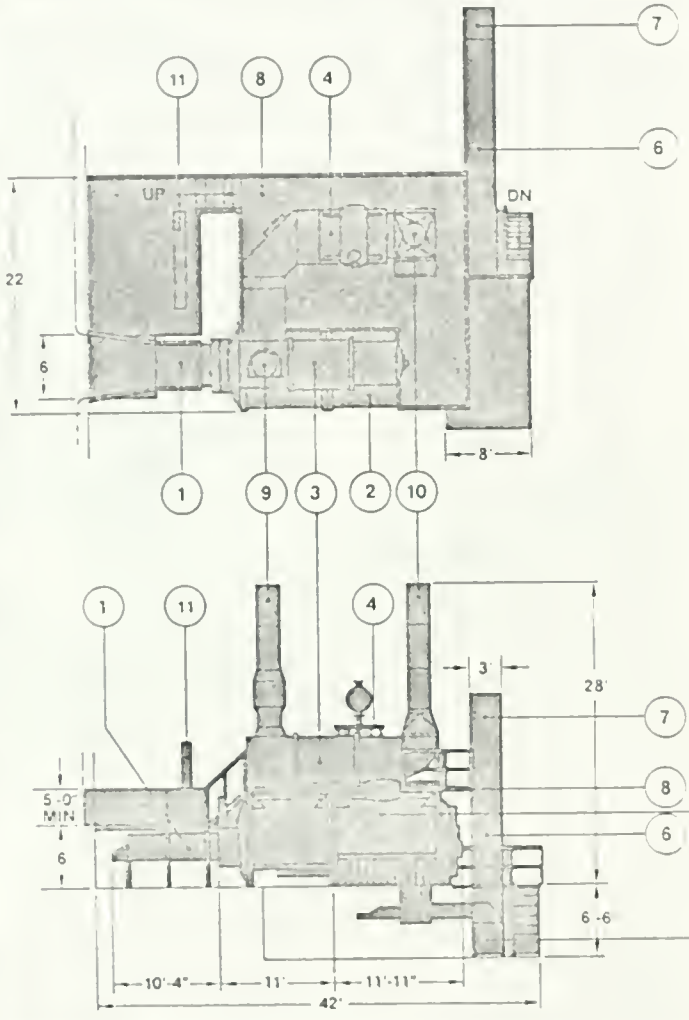
Four processing modules can be coupled to either two or three energy systems to give even more overall flexibility. A very large turn down ratio is possible with this arrangement. Since efficiency need not be sacrificed due to off design performance, the Quad Pac has more flexibility than the other two systems. A wide range of options is available both in size and combination of components.

Steam Production from Sources other than Solid Waste

Any of the above systems as well as single modules or other combinations not shown can be fitted with fossil fuel burners to provide steam backup when solid waste may not be available. Consumat Systems' factory engineers can provide details for a wide variety of fuel capabilities.

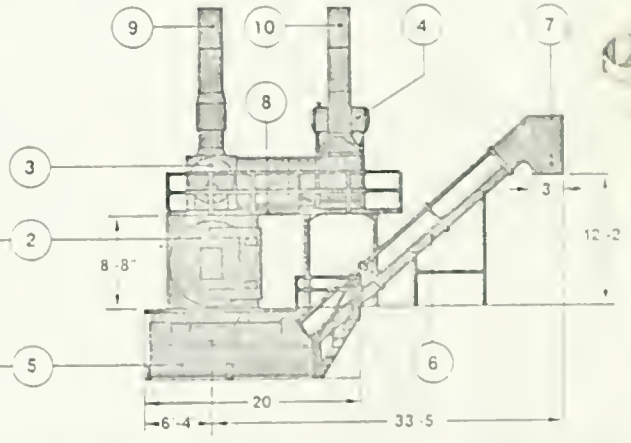


CS-800 with Energy



(Dimensions for Reference Only)

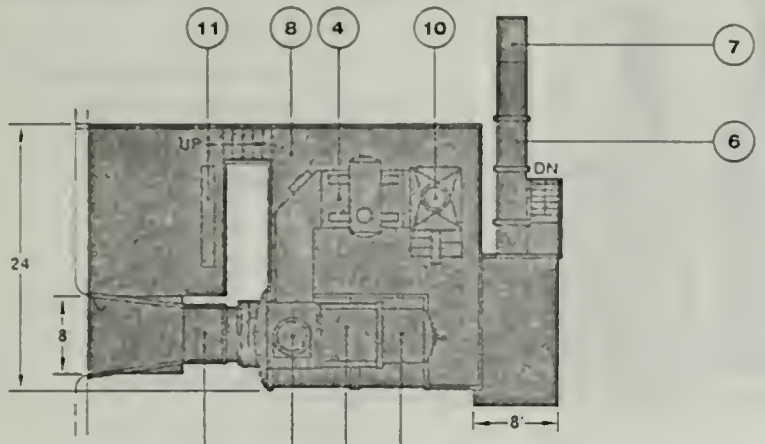
1. LOADER
2. GAS PRODUCTION CHAMBER
3. OXIDATION CHAMBER
4. ENERGY SYSTEM
5. WET ASH SUMP
6. ASH CONVEYOR
7. ASH DISCHARGE
8. STRUCTURAL PLATFORM
9. DUMP STACK
10. ENERGY STACK
11. CONTROL PANEL



PERFORMANCE PARAMETERS[2]	Typical Municipal Waste 4500 BTU/LB	Typical Industrial Waste 7000 BTU/LB
Waste Processing Capability, LB/HR	1,250	1,250
Steam Production,[3] LB/HR	3,200	4,950
Auxiliary Fuel Consumption (continuous operation), BTU/TON (AVG)	250,000	250,000
Electrical Consumption, KWH/TON (AVG)	25	25
Approximate System Weight, LB	80,000	80,000

[1] Above dimensions for reference only. Contact factory for additional information.
[2] Performance shown is for a typical system. Specific information should be obtained from the factory.
[3] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact Consumat Systems, Inc. for other pressures and conditions. Higher efficiencies are available at additional cost.

CS-1000 with Energy



(Dimensions for Reference Only)

1. LOADER
2. GAS PRODUCTION CHAMBER
3. OXIDATION CHAMBER
4. ENERGY SYSTEM
5. WET ASH SUMP
6. ASH CONVEYOR
7. ASH DISCHARGE
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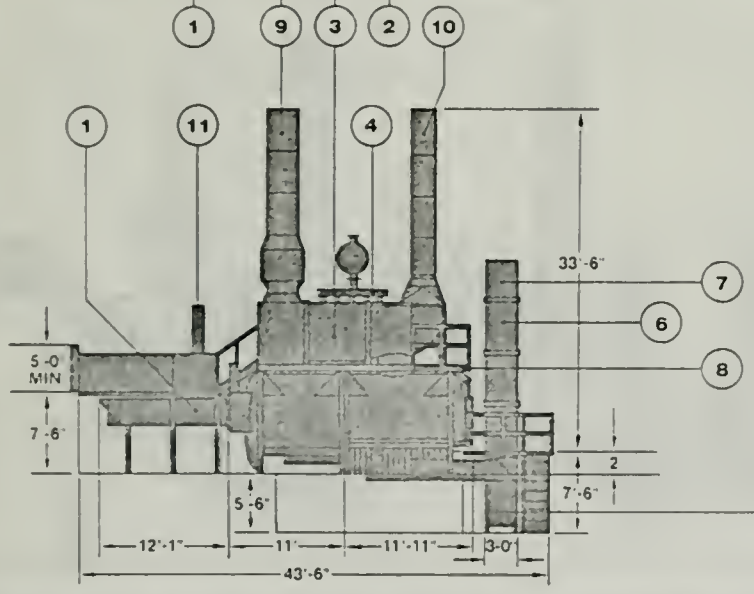
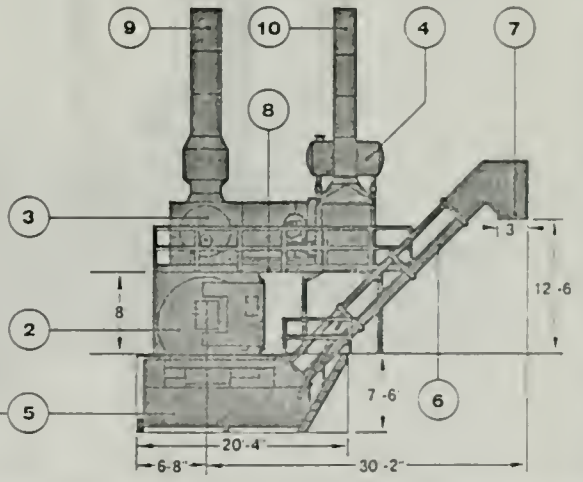
9. DUMP STACK
10. ENERGY STACK
11. CONTROL PANEL

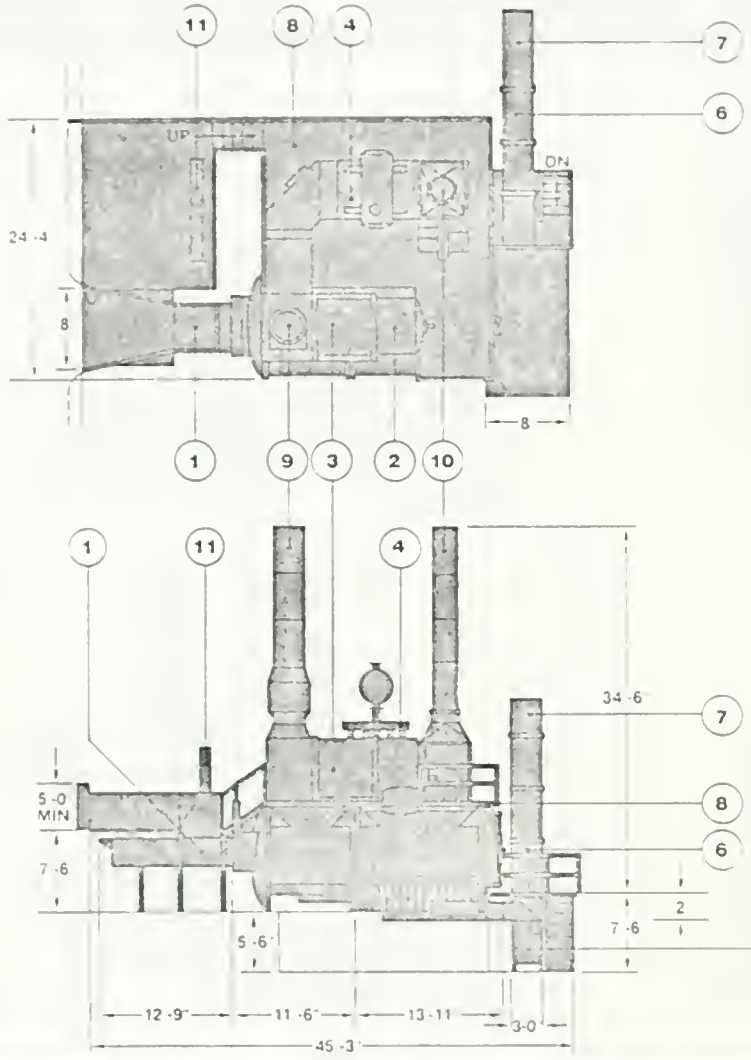


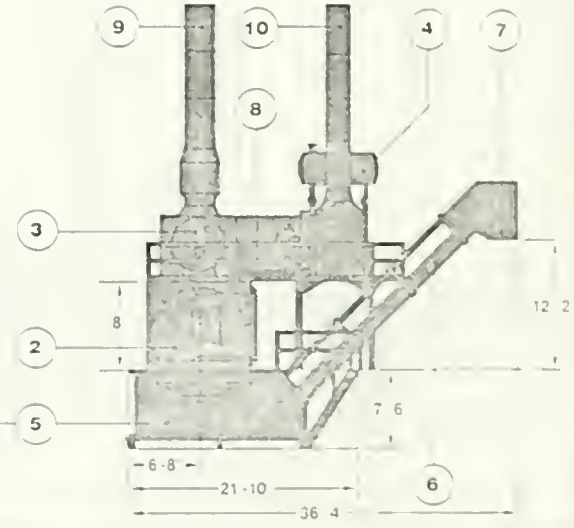


PERFORMANCE PARAMETERS[2]	Typical Municipal Waste 4500 BTU/LB	Typical Industrial Waste 7000 BTU/LB
Waste Processing Capability, LB/HR	1,650	1,650
Steam Production,[3] LB/HR	4,200	6,570
Auxiliary Fuel Consumption (continuous operation), BTU/TON (AVG)	250,000	250,000
Electrical Consumption, KWH/TON (AVG)	25	25
Approximate System Weight, LB	150,000	110,000

[1] Above dimensions for reference only. Contact factory for additional information.
[2] Performance shown is for a typical system. Specific information should be obtained from the factory.
[3] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact Consumat Systems, Inc. for other pressures and conditions. Higher efficiencies are available at additional cost.

CS-1200 with Energy





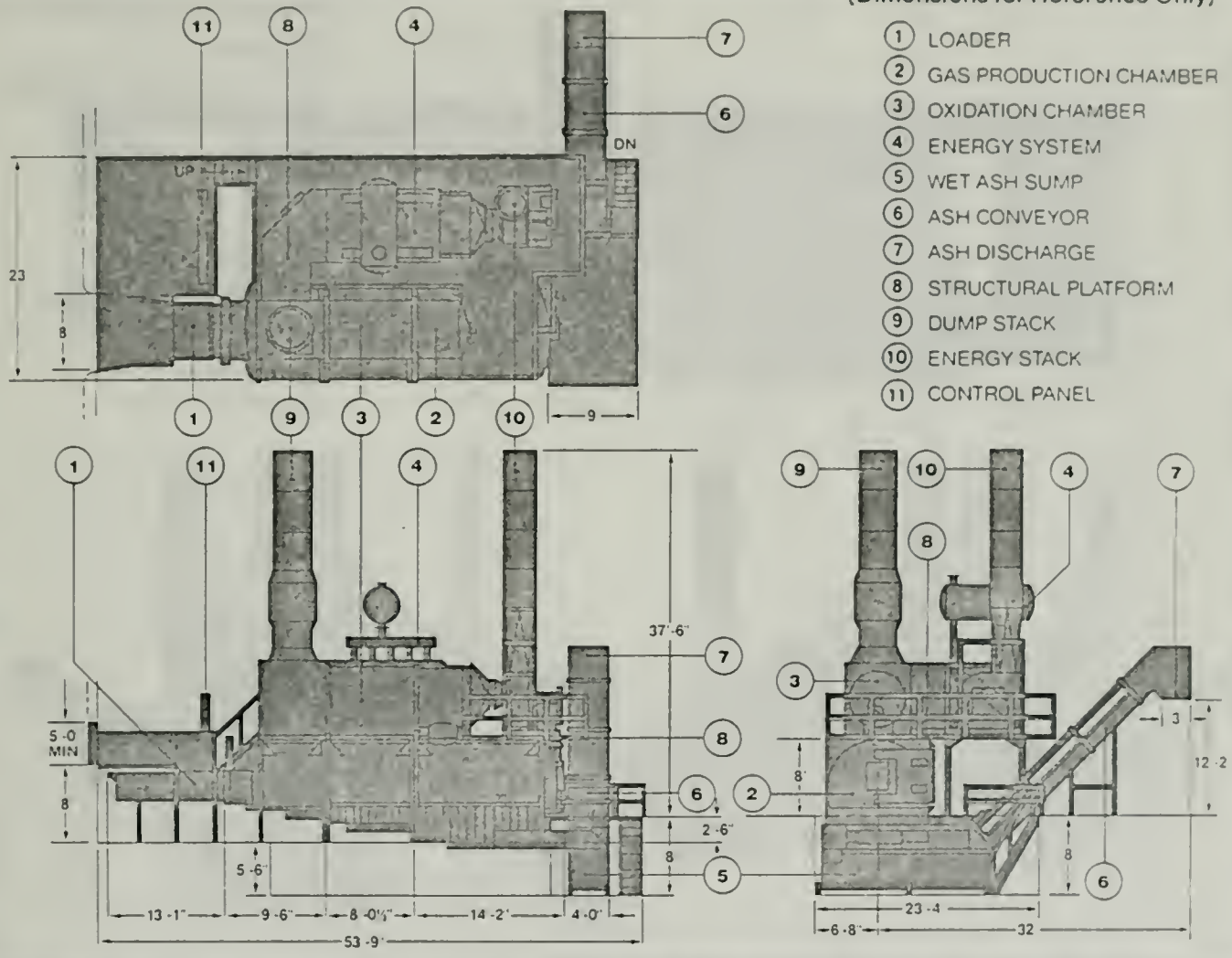
(Dimensions for Reference Only)

1. LOADER
2. GAS PRODUCTION CHAMBER
3. OXIDATION CHAMBER
4. ENERGY SYSTEM
5. WET ASH SUMP
6. ASH CONVEYOR
7. ASH DISCHARGE
8. STRUCTURAL PLATFORM
9. DUMP STACK
10. ENERGY STACK
11. CONTROL PANEL

PERFORMANCE PARAMETERS[2]	Typical Municipal Waste 4500 BTU/LB	Typical Industrial Waste 7000 BTU/LB
Waste Processing Capability, LB/HR	2,100	2,100
Steam Production,[3] LB/HR	5,400	8,400
Auxiliary Fuel Consumption (continuous operation), BTU/TON (AVG)	250,000	250,000
Electrical Consumption, KWH/TON (AVG)	25	25
Approximate System Weight, LB	200,000	200,000

[1] Above dimensions for reference only. Contact factory for additional information.
[2] Performance shown is for a typical system. Specific information should be obtained from the factory.
[3] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact Consumat Systems, Inc. for other pressures and conditions. Higher efficiencies are available at additional cost.

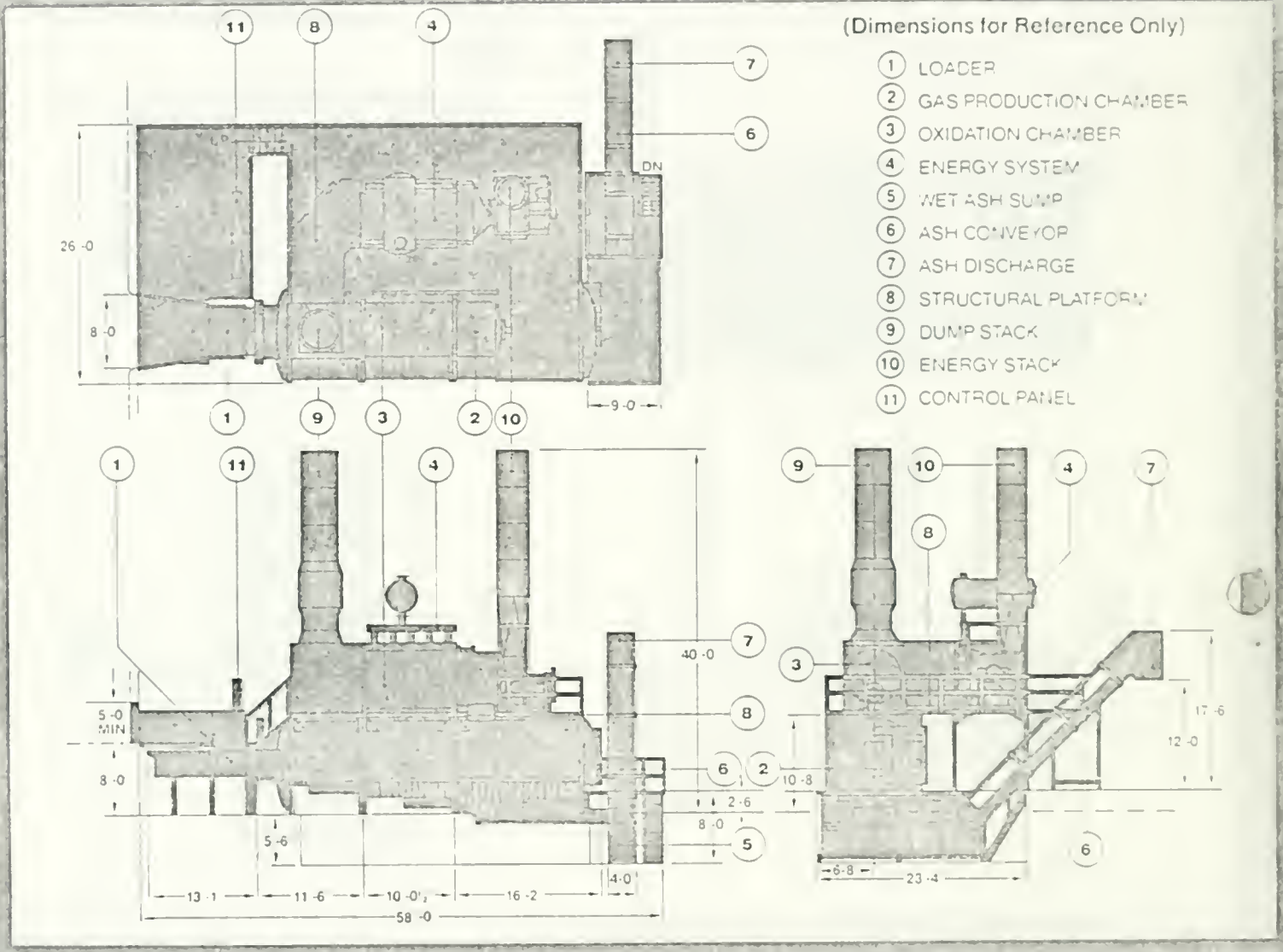
CS-1600 with Energy



PERFORMANCE PARAMETERS[2]	Typical Municipal Waste 4500 BTU/LB	Typical Industrial Waste 7000 BTU/LB
Waste Processing Capability, LB/HR	3,000	3,000
Steam Production,[3] LB/HR	7,700	11,950
Auxiliary Fuel Consumption (continuous operation), BTU/TON (AVG)	250,000	250,000
Electrical Consumption, KWH/TON (AVG)	25	25
Approximate System Weight, LB	225,000	225,000

[1] Above dimensions for reference only. Contact factory for additional information.
[2] Performance shown is for a typical system. Specific information should be obtained from the factory.
[3] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact Consumat Systems, Inc. for other pressures and conditions. Higher efficiencies are available at additional cost.

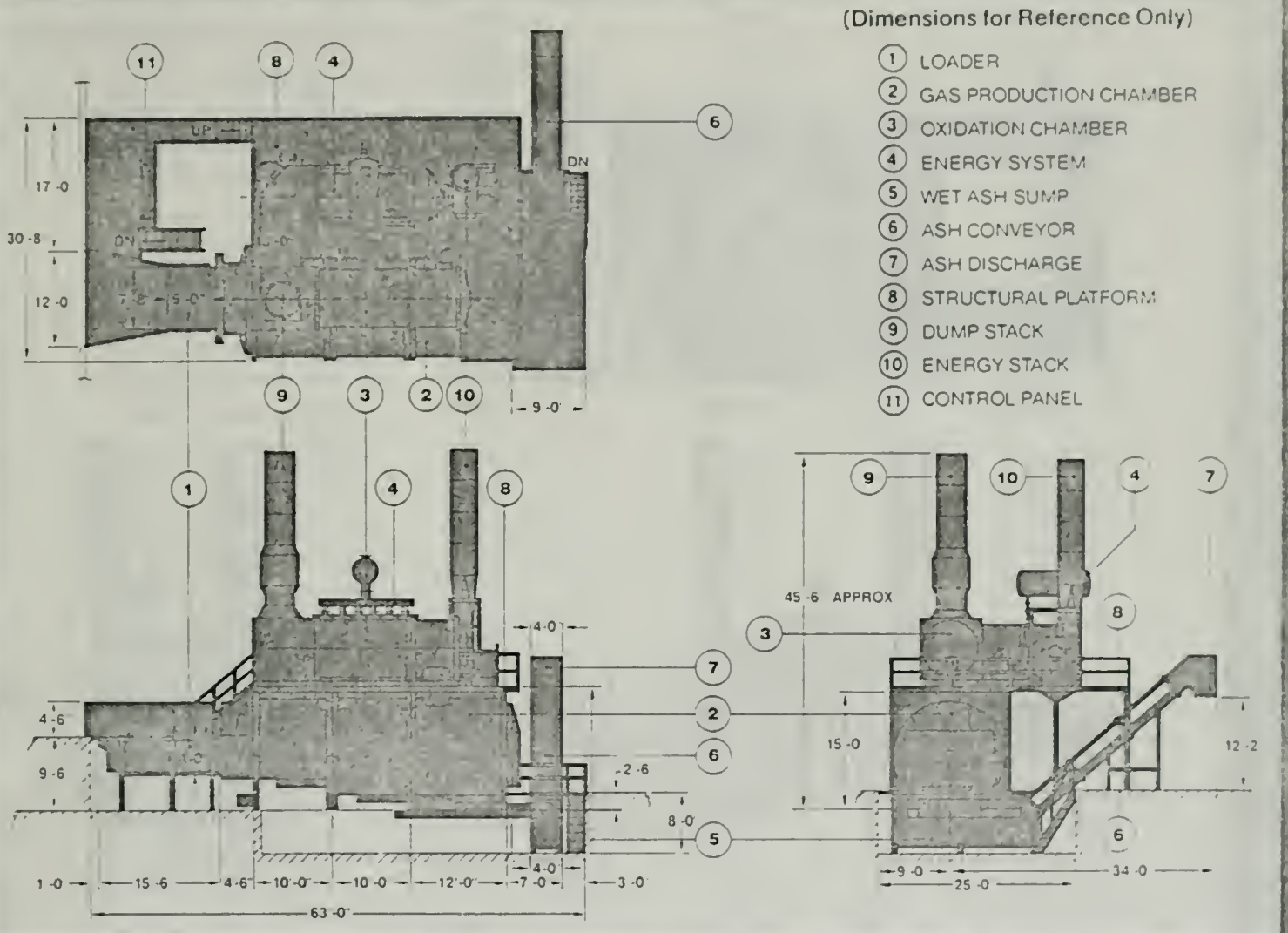
CS-2000 with Energy



PERFORMANCE PARAMETERS [2]	Typical Municipal Waste 4500 BTU/LB	Typical Industrial Waste 7000 BTU/LB
Waste Processing Capability, LB/HR	4,100	4,100
Steam Production, [3] LB/HR	10,540	16,400
Auxiliary Fuel Consumption (continuous operation), BTU/TON (AVG)	250,000	250,000
Electrical Consumption, KWH/TON (AVG)	25	25
Approximate System Weight, LB	250,000	250,000

[1] Above dimensions for reference only. Contact factory for additional information.
[2] Performance shown is for a typical system. Specific information should be obtained from the factory.
[3] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact Consumat Systems, Inc. for other pressures and conditions. Higher effeciencies are available at additional cost.

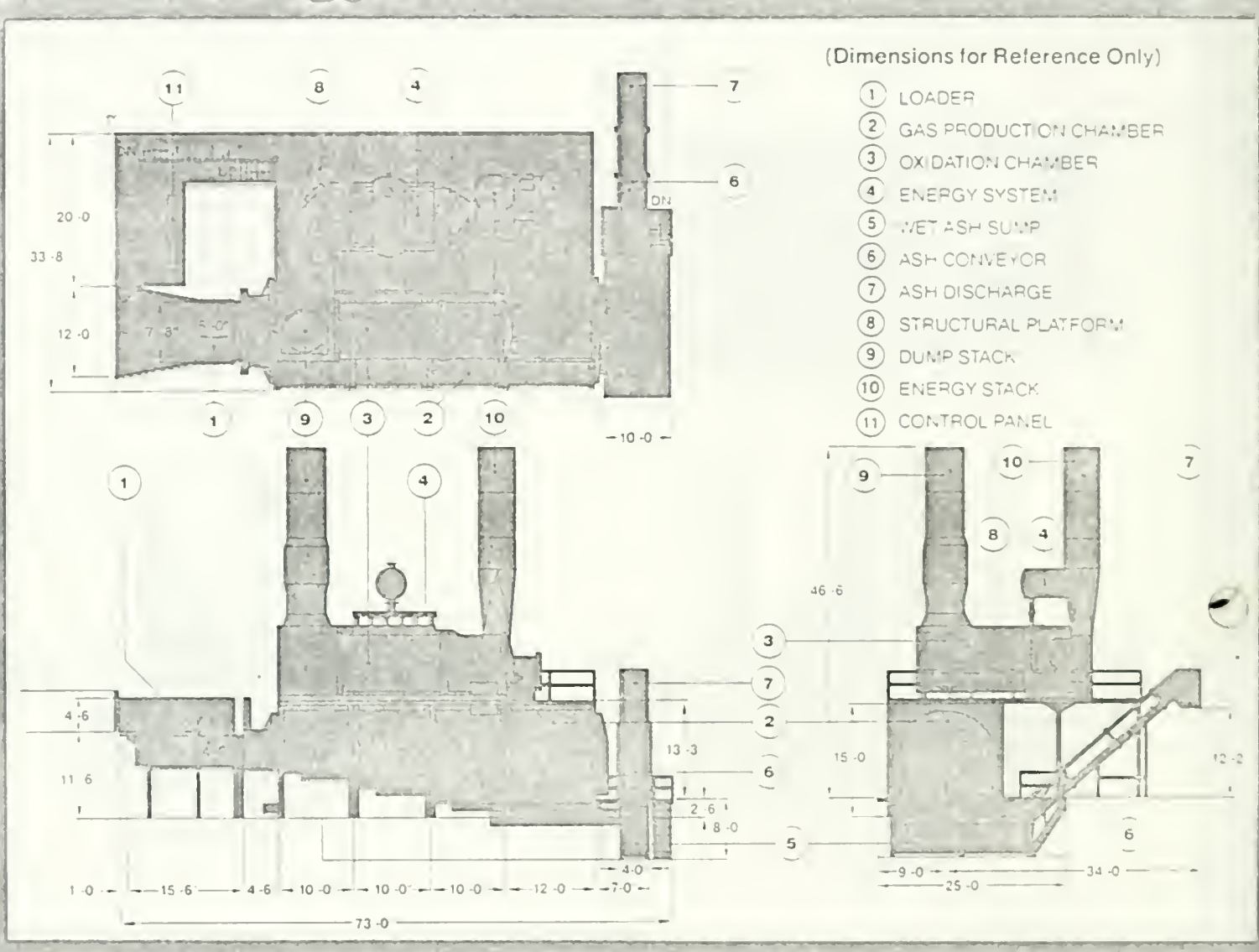
CS-3000 with Energy



PERFORMANCE PARAMETERS[2]	Typical Municipal Waste 4500 BTU/ LB	Typical Industrial Waste 7000 BTU/LB
Waste Processing Capability, LB/HR	6,250	6,250
Steam Production,[3] LB/HR	16,100	25,000
Auxiliary Fuel Consumption (continuous operation), BTU/TON (AVG)	250,000	250,000
Electrical Consumption, KWH/TON (AVG)	25	25
Approximate System Weight, LB	300,000	300,000

[1] Above dimensions for reference only. Contact factory for additional information.
[2] Performance shown is for a typical system. Specific information should be obtained from the factory.
[3] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact Consumat Systems, Inc. for other pressures and conditions. Higher efficiencies are available at additional cost.

CS-4000 with Energy



PERFORMANCE PARAMETERS [2]	Typical Municipal Waste 4500 BTU/LB	Typical Industrial Waste 7000 BTU/LB
Waste Processing Capability, LB/HR	8,400	8,400
Steam Production,[3] LB/HR	21,600	33,600
Auxiliary Fuel Consumption (continuous operation), BTU/TON (AVG)	250,000	250,000
Electrical Consumption, KWH/TON (AVG)	25	25
Approximate System Weight, LB	350,000	350,000

[1] Above dimensions for reference only. Contact factory for additional information.
[2] Performance shown is for a typical system. Specific information should be obtained from the factory.
[3] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact Consumat Systems, Inc. for other pressures and conditions. Higher efficiencies are available at additional cost.

Systems Performance Guide

The table below gives nominal performance figures for standard equipment. Performance guarantees are available for all Consumat installations.

MODELS	Burning Rate LB/HR	Steam Production LB/HR(1)	
		Typical Industrial Waste 7000 BTU/LB	Typical Municipal Waste 4500 BTU/LB
CS-800	1,250	4,950	3,200
CS-1000	1,650	6,570	4,200
CS-1200	2,100	8,400	5,400
CS-1600	3,000	11,950	7,700
CS-2000	4,100	16,400	10,540
CS-3000	6,250	25,000	16,100
CS-4000	8,400	33,600	21,600
Dual 800	2,500	9,900	6,400
Dual 1000	3,300	13,100	8,400
Dual 1200	4,200	16,800	10,800
Dual 1600	6,000	23,900	15,400
Dual 2000	8,200	33,600	21,080
Dual 3000	12,500	50,000	32,200
Dual 4000	16,800	67,000	43,200
Tri Pac 800	3,750	14,900	9,600
Tri Pac 1000	4,950	19,700	12,600
Tri Pac 1200	6,300	25,200	16,200
Tri Pac 1600	9,000	35,900	23,100
Tri Pac 2000	12,300	49,200	31,620
Tri Pac 3000	18,750	75,000	48,300
Tri Pac 4000	25,200	101,000	64,800
Quad Pac 800	5,000	19,800	12,800
Quad Pac 1000	6,600	26,300	16,800
Quad Pac 1200	8,400	33,600	21,600
Quad Pac 1600	12,000	47,800	30,800
Quad Pac 2000	16,400	65,600	42,160
Quad Pac 3000	25,000	100,000	64,400
Quad Pac 4000	33,600	134,400	86,400
Penta Pac 800	6,250	24,800	16,000
Penta Pac 1000	8,250	32,800	21,000
Penta Pac 1200	10,500	42,000	27,000
Penta Pac 1600	15,000	59,800	38,500
Penta Pac 2000	20,500	82,000	52,700
Penta Pac 3000	31,250	125,000	80,500
Penta Pac 4000	42,000	168,000	108,000
OTHER MODELS			
C-125A(2)	250	1,000	Not Recommended
C-225A	425	1,700	"
C-325A	600	2,400	1,540
CS-225	425	1,700	1,100
CS-325	600	2,400	1,540
CS-550	900	3,550	2,280
CS-760	1,250	4,950	3,200

(1) All calculations are for nominal systems (150 psi saturated). Full range of pressures and efficiencies are available as standard equipment. Contact factory for specifics.

(2) "A" models generally used for continuous operations when waste quality is assured. Larger sizes are available in "CS" version only.

Typical Systems

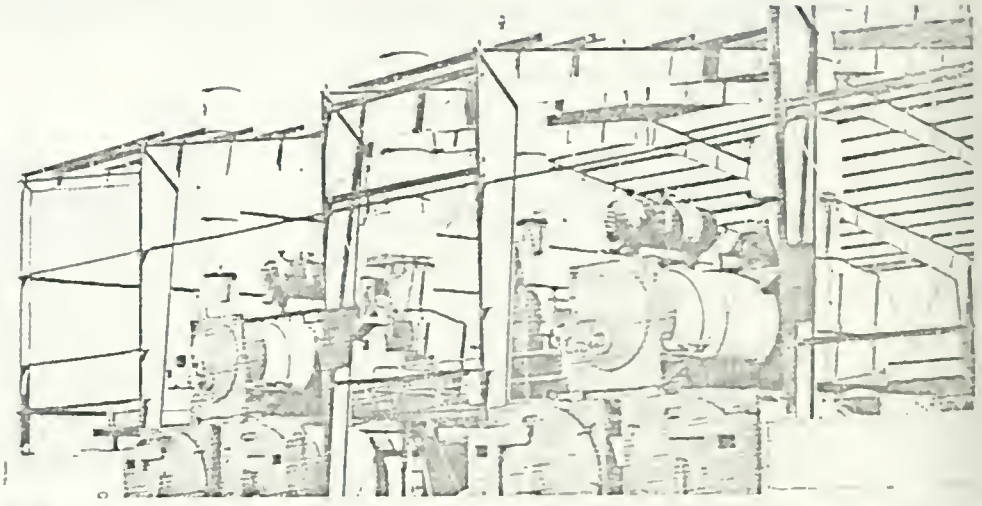
The information presented on the following pages is intended to aid industry, municipalities and engineering firms in preparing their preliminary energy-from-waste economic evaluations. We have shown typical CONSUMAT® arrangements for several of the larger modular systems. The layouts are shown to give general space requirements. The arrangements shown and the performance listed are intended only as aids in initial planning. In addition to these arrangements, there are several other combinations of equipment which may be used for each system. Average installations are presented, however, every application has certain special requirements and the CONSUMAT® factory engineers should be consulted prior to any final system planning.

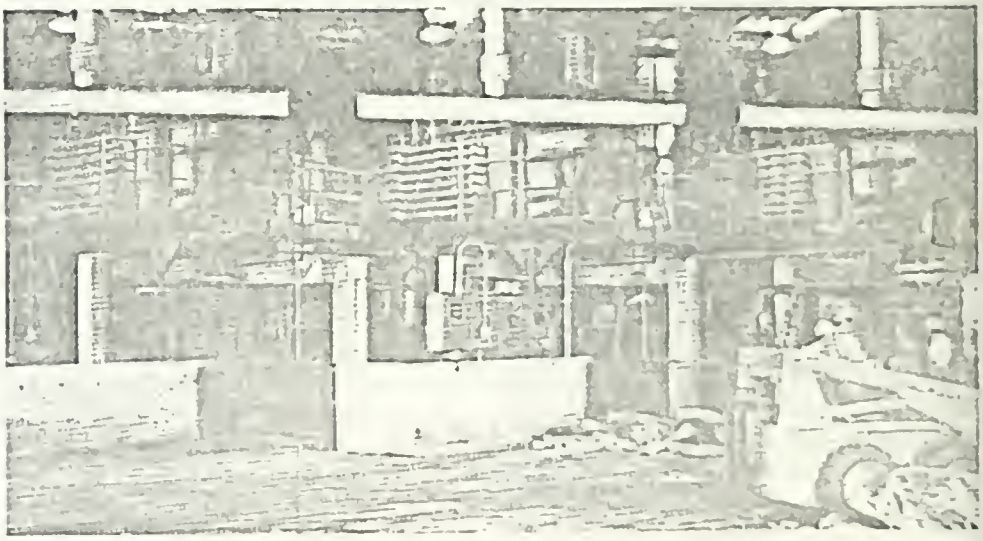
The cost factors shown are for five day per week, 24 hour per day operations. Most systems operate under these conditions. Seven day per week operations are preferred if steam is needed. Operating cost must then, of course, be adjusted and additional equipment must be added to provide redundancy.

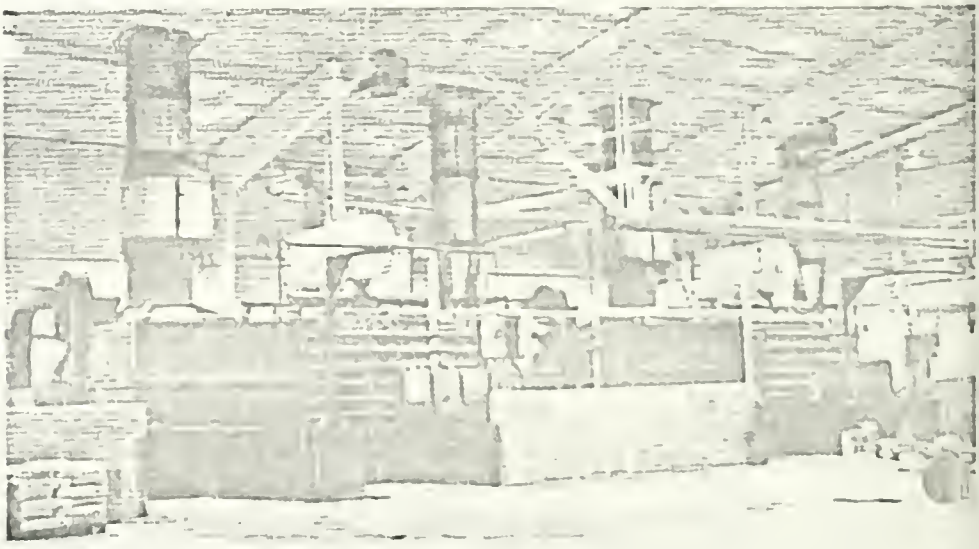
System availability varies with equipment arrangements and operating conditions. Proper planning and operation assures high availibility.

The following costs are inherent in all systems but are not shown as typical of any situation since they are site specific and must be estimated separately for each installation.

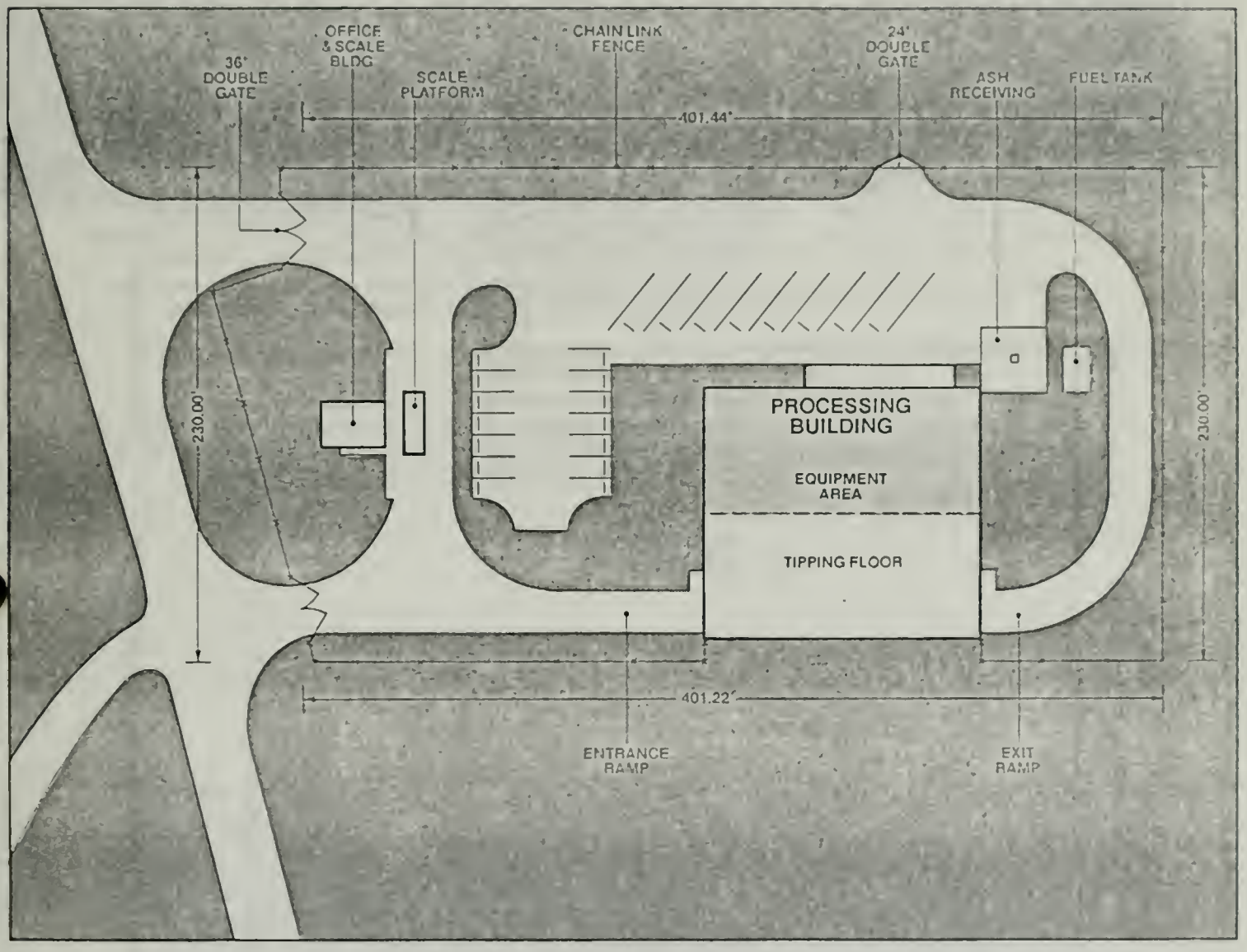
- Amortization of land, equipment and building costs
- Fuel and maintenance for service vehicles
- Loading and ash hauling
- Insurance and taxes, if applicable
- Building maintenance
- Janitorial services
- Accounting services
- Chemicals for water treatment
- Snow removal (where necessary)
- Building heating cost – if systems are to be shut down for weekends or holidays







Typical Site Plan



The site plan shown above is typical of a spacious facility processing 100 tons per day of municipal waste. Industrial facilities can generally be situated in considerably less space. Larger systems require more parking and building area.

100 Ton per day installed processing capacity

PERFORMANCE AND OPERATION		
Personnel Requirement[1]		Recommended CONSUMAT® Equipment Two Dual 1200 Modules Two energy systems
Plant Manager	1	
Scale Operator	1	
Maintenance Mechanic	1	
Operators	6	
Shift Manager	2	
TOTAL PERSONNEL	11	
Auxiliary Fuel Consumption[2]		250,000 Btu/Ton processed (average)
Electrical Power Consumption		2,500 KWH/Day
Maintenance[3]		$1.75 per ton processed
STEAM PRODUCTION[4]		
Typical Municipal, 4500 Btu (Net)		518,400 Lbs./Day
Typical Industrial, 7000 Btu (Net)		806,400 Lbs./Day

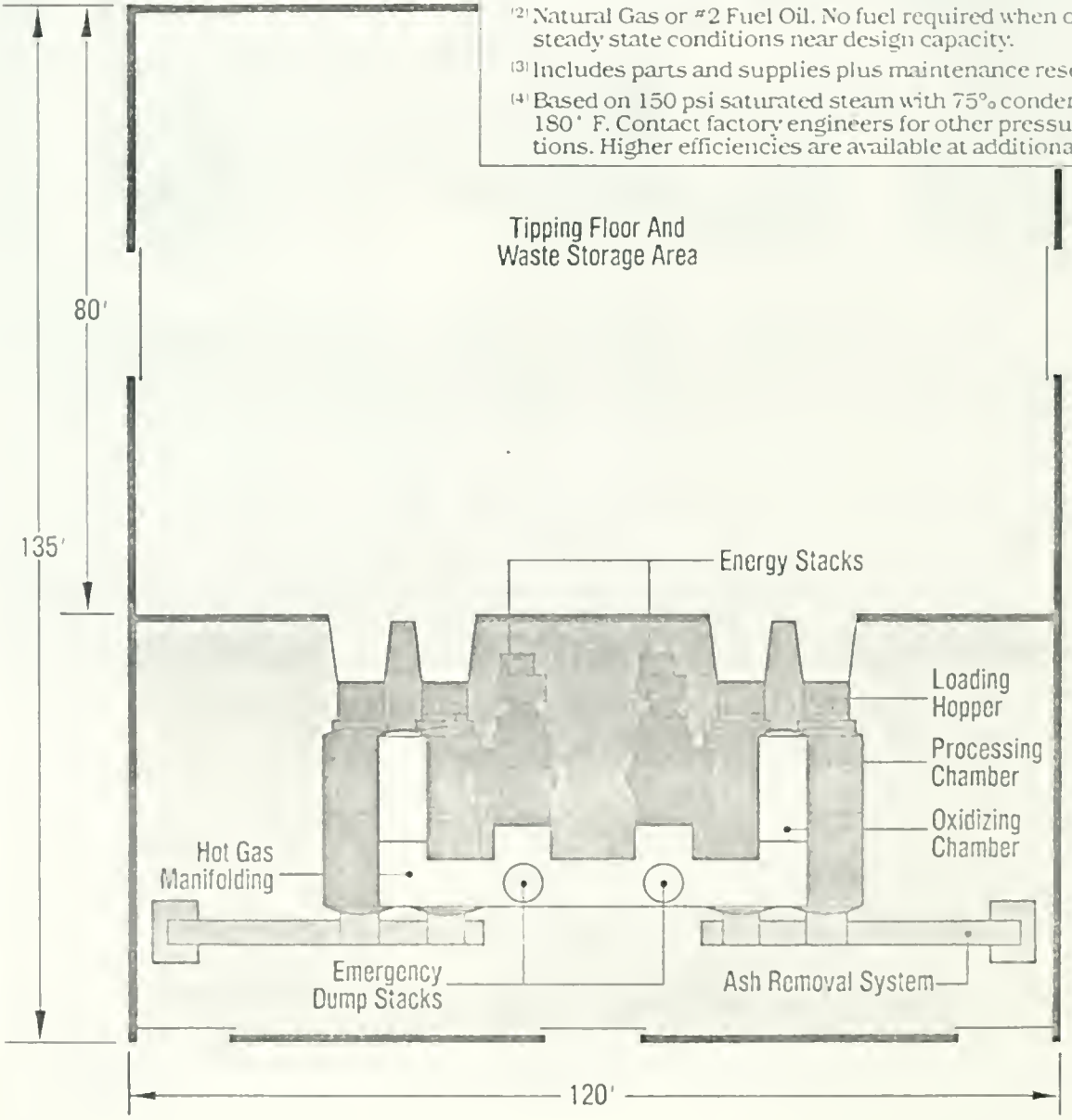
Notes: Equipment arrangement and performance is shown for a typical system and should be used only as a guide. Contact the factory for specific applications. See Page 17 for additonal information.

[1] Based on 24 hrs. per day five days per week for typical municipal operations. Industrial applications generally require less personnel.

[2] Natural Gas or #2 Fuel Oil. No fuel required when operated at steady state conditions near design capacity.

[3] Includes parts and supplies plus maintenance reserve fund.

[4] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact factory engineers for other pressures and conditions. Higher efficiencies are available at additional cost.



200 Ton per day installed processing capacity

PERFORMANCE AND OPERATION		
Personnel Requirement[1]		Recommended CONSUMAT Equipment Four CS-2000 Modules Two energy systems
Plant Manager	1	
Scale Operator	1	
Maintenance Mechanic	2	
Operators	6	
Shift Manager	2	
TOTAL PERSONNEL	12	
Auxiliary Fuel Consumption[2]		250,000 Btu/Ton processed (average)
Electrical Power Consumption		5,000 KWH/Day
Maintenance[3]		$1.75 per ton processed
		STEAM PRODUCTION[4]
Typical Municipal, 4500 Btu (Net)		1,036,800 Lbs./Day
Typical Industrial, 7000 Btu (Net)		1,612,800 Lbs./Day

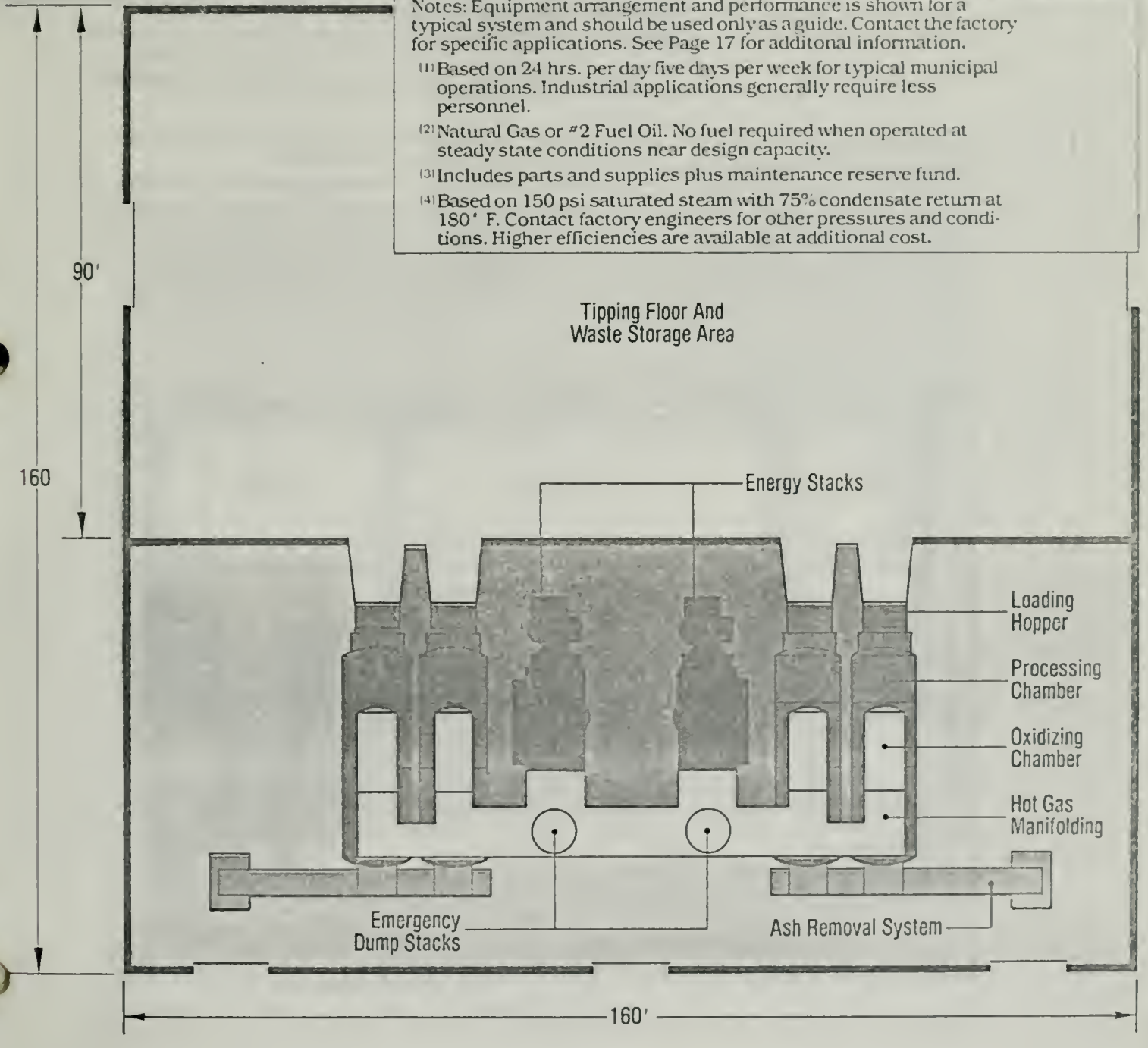
Notes: Equipment arrangement and performance is shown for a typical system and should be used only as a guide. Contact the factory for specific applications. See Page 17 for additonal information.

[1] Based on 24 hrs. per day five days per week for typical municipal operations. Industrial applications generally require less personnel.

[2] Natural Gas or #2 Fuel Oil. No fuel required when operated at steady state conditions near design capacity.

[3] Includes parts and supplies plus maintenance reserve fund.

[4] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact factory engineers for other pressures and conditions. Higher efficiencies are available at additional cost.



300 Ton per day installed processing capacity

PERFORMANCE AND OPERATION		
Personnel Requirement [1]		Recommended CONSUMAT® Equipment
Plant Manager & Assistant	2	
Scale Operator	1	
Maintenance Mechanic	3	Four CS-3000 Modules
Operators	6	Two energy systems
Shift Manager	2	
TOTAL PERSONNEL	14	
Auxiliary Fuel Consumption [2]		250,000 Btu/Ton processed (average)
Electrical Power Consumption		7,500 KWH/Day
Maintenance [3]		$1.75 per ton processed
		STEAM PRODUCTION [4]
Typical Municipal, 4500 Btu (Net)		1,555,200 Lbs./Day
Typical Industrial, 7000 Btu (Net)		2,419,200 Lbs./Day

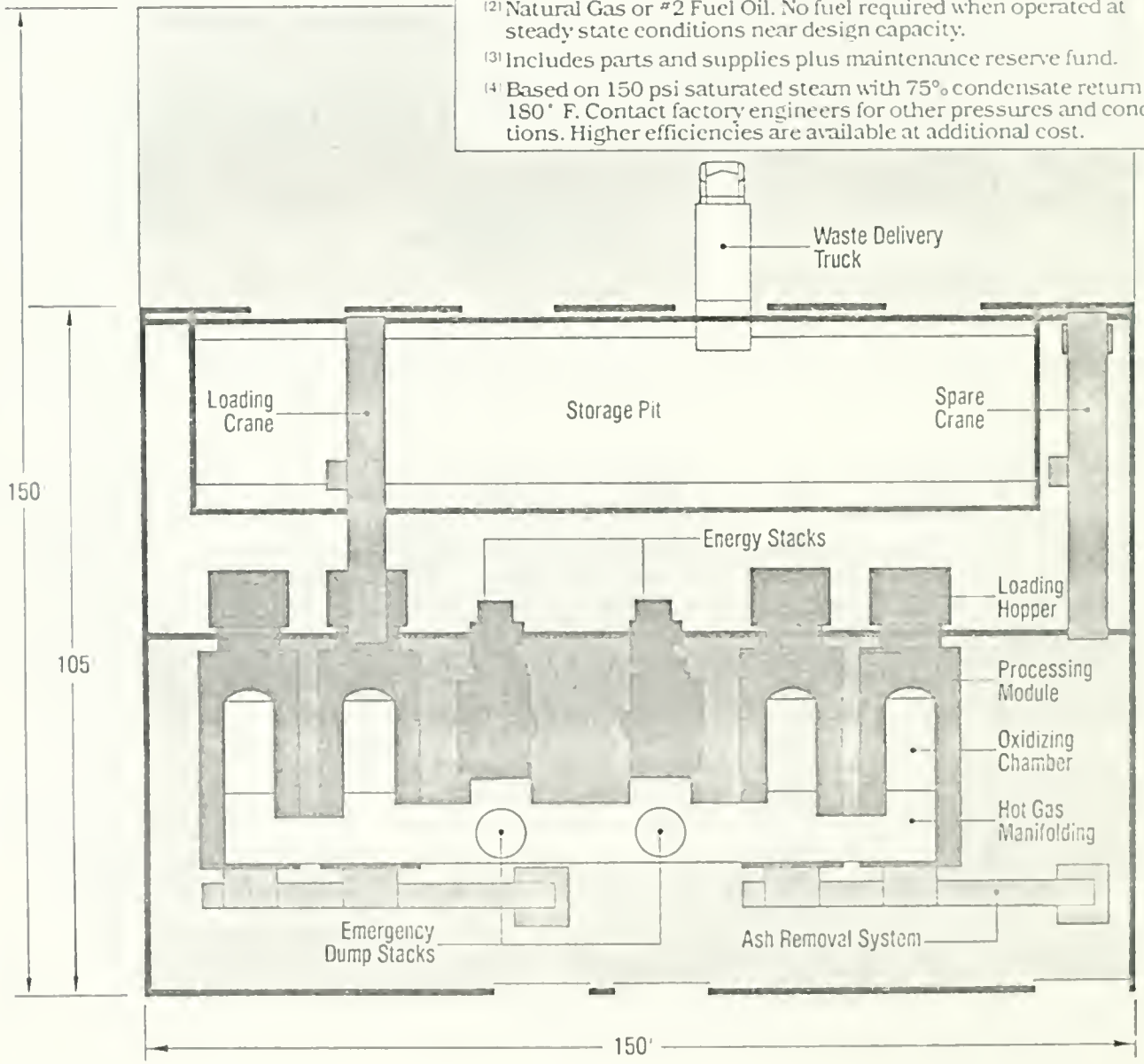
Notes: Equipment arrangement and performance is shown for a typical system and should be used only as a guide. Contact the factory for specific applications. See Page 17 for additonal information.

[1] Based on 24 hrs. per day five days per week for typical municipal operations. Industrial applications generally require less personnel.

[2] Natural Gas or #2 Fuel Oil. No fuel required when operated at steady state conditions near design capacity.

[3] Includes parts and supplies plus maintenance reserve fund.

[4] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact factory engineers for other pressures and conditions. Higher efficiencies are available at additional cost.



400 Ton per day installed processing capacity

PERFORMANCE AND OPERATION		
Personnel Requirement[1]		Recommended CONSUMAT Equipment
Plant Manager & Assistant	2	Four CS-4000 Modules
Scale Operator	1	Three energy systems
Maintenance Mechanic	4	
Operators	6	
Shift Manager	2	
TOTAL PERSONNEL	15	
Auxiliary Fuel Consumption[2]		250,000 Btu/Ton processed (average)
Electrical Power Consumption		10,000 KWH/Day
Maintenance[3]		$1.75 per ton processed
		STEAM PRODUCTION[4]
Typical Municipal, 4500 Btu (Net)		2,073,600 Lbs./Day
Typical Industrial, 7000 Btu (Net)		3,225,600 Lbs./Day

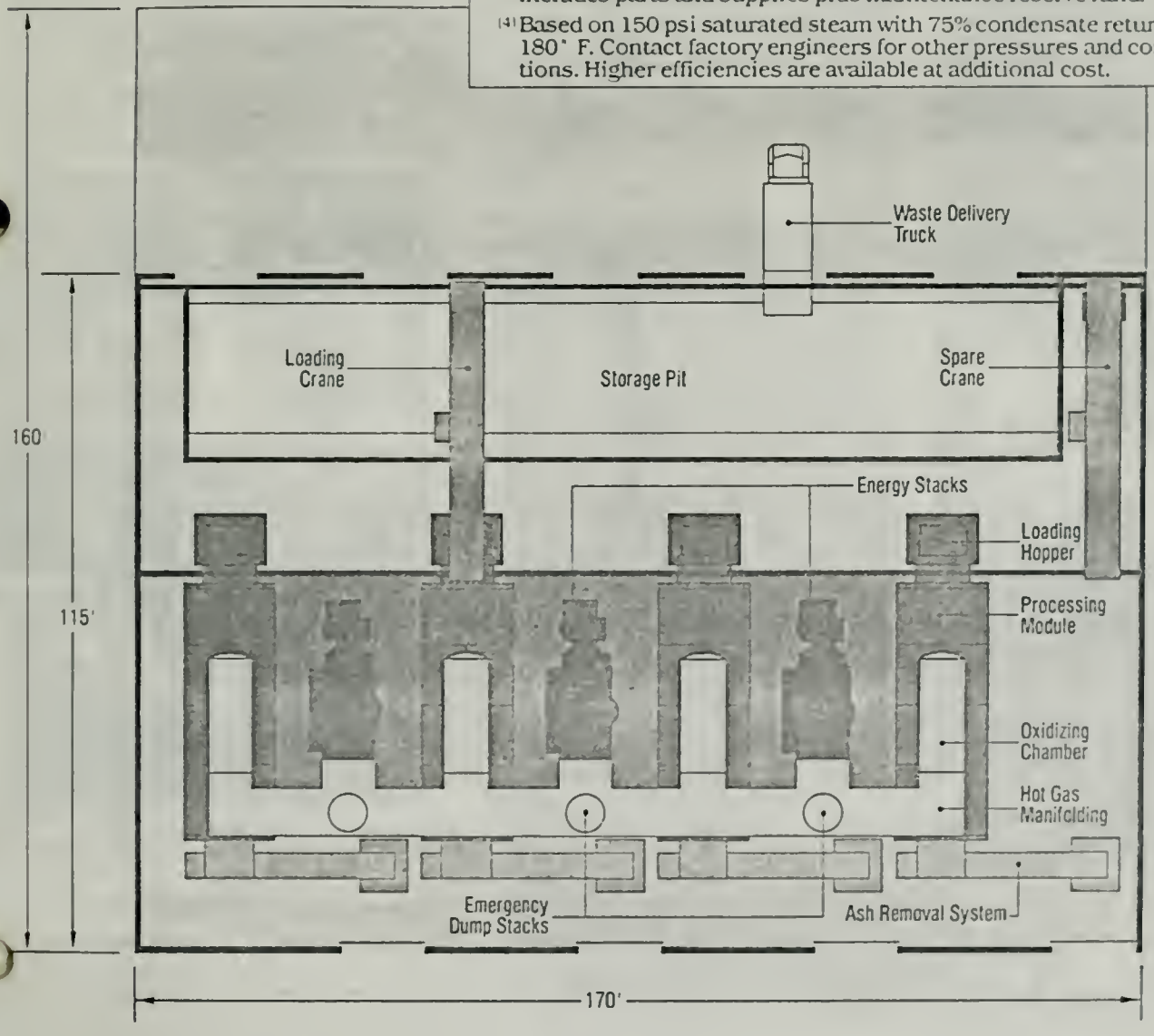
Notes: Equipment arrangement and performance is shown for a typical system and should be used only as a guide. Contact the factory for specific applications. See Page 17 for additonal information.

[1] Based on 24 hrs. per day five days per week for typical municipal operations. Industrial applications generally require less personnel.

[2] Natural Gas or #2 Fuel Oil. No fuel required when operated at steady state conditions near design capacity.

[3] Includes parts and supplies plus maintenance reserve fund.

[4] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact factory engineers for other pressures and conditions. Higher efficiencies are available at additional cost.



500 Ton per day installed processing capacity

PERFORMANCE AND OPERATION		
Personnel Requirement[1]		Recommended CONSUMAT® Equipment
Plant Manager & Assistant	2	
Scale Operator	1	
Maintenance Mechanic	5	Five CS-4000 Modules
Operators	6	Four energy systems
Shift Manager	2	
TOTAL PERSONNEL	16	
Auxiliary Fuel Consumption[2]		250,000 Btu. Ton processed (average)
Electrical Power Consumption		12,500 KWH/Day
Maintenance[3]		$1.75 per ton processed
		STEAM PRODUCTION[4]
Typical Municipal, 4500 Btu (Net)		2,592,000 Lbs./Day
Typical Industrial, 7000 Btu (Net)		4,032,000 Lbs./Day

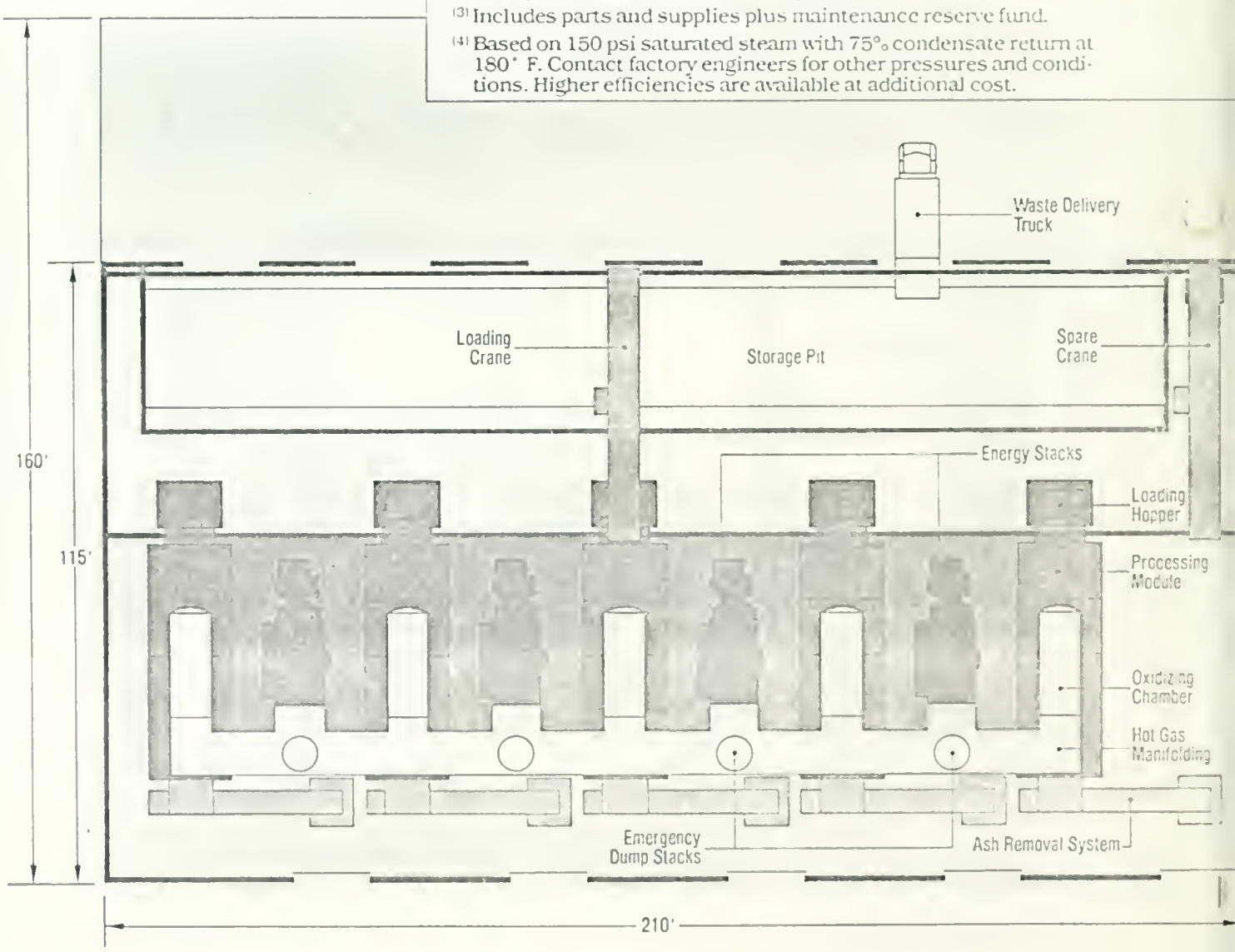
Notes: Equipment arrangement and performance is shown for a typical system and should be used only as a guide. Contact the factory for specific applications. See Page 17 for additonal information.

[1] Based on 24 hrs. per day five days per week for typical municipal operations. Industrial applications generally require less personnel.

[2] Natural Gas or #2 Fuel Oil. No fuel required when operated at steady state conditions near design capacity.

[3] Includes parts and supplies plus maintenance reserve fund.

[4] Based on 150 psi saturated steam with 75% condensate return at 180° F. Contact factory engineers for other pressures and conditions. Higher efficiencies are available at additional cost.



People

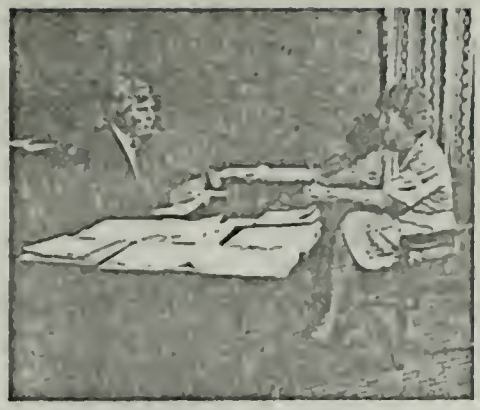
While Consumat Systems' principles and products are both important factors, it is the combined corporate knowhow of 120 people that assures success of the CONSUMAT ® energy system.

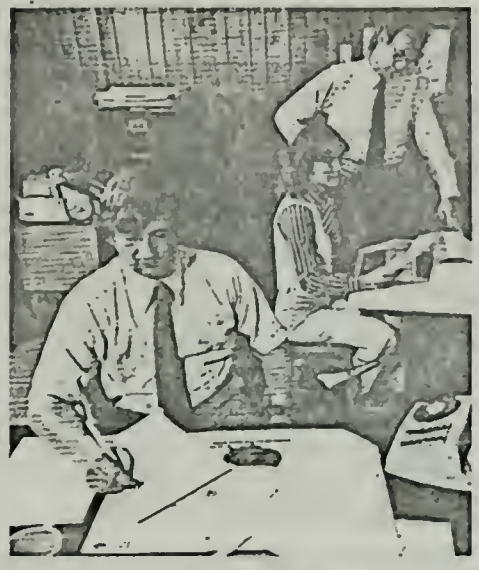
Our technical staff incorporates a combined total of 200 years experience in combustion and high temperature technology.

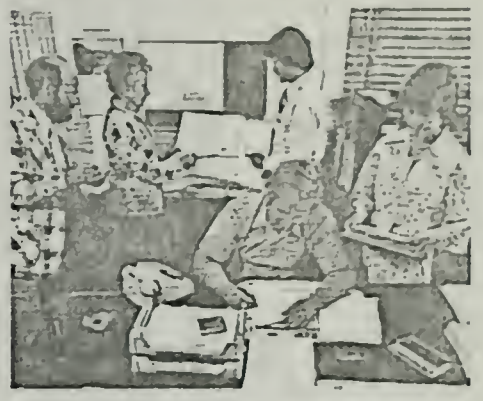
CONSUMAT ® equipment is fabricated by trained craftsmen in our specially equipped factory. Some of our fabricators have been with us since the organization of the company in 1965.

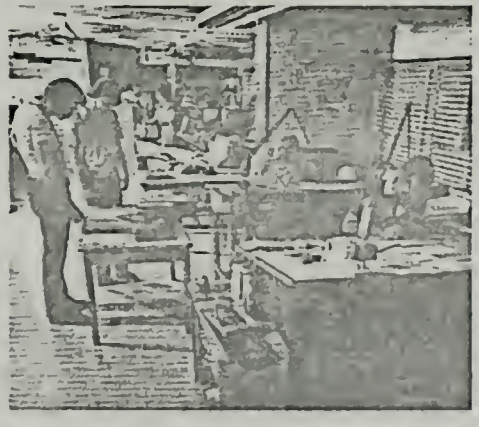
Consumat Systems is the only company with personnel who have extensive experience in the operation of continuous duty small modular systems. Consumat Systems' field representation by 37 independent organizations rounds out our national sales and service capability.

The important lesson of our experience is that experience itself is a critical necessity.

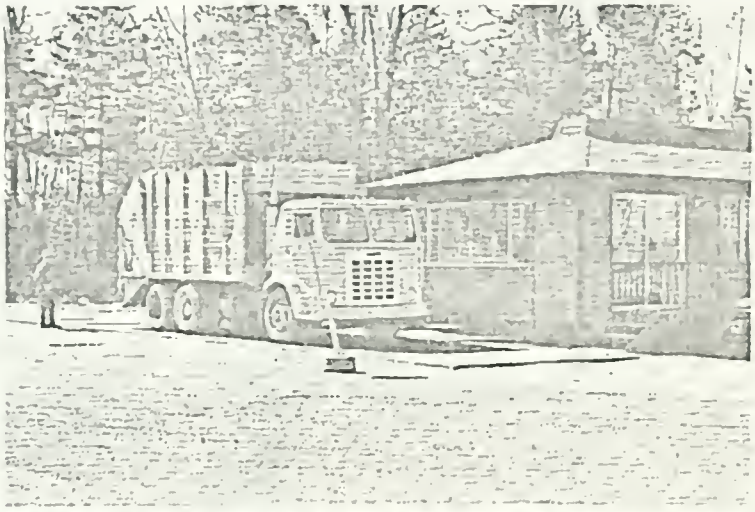






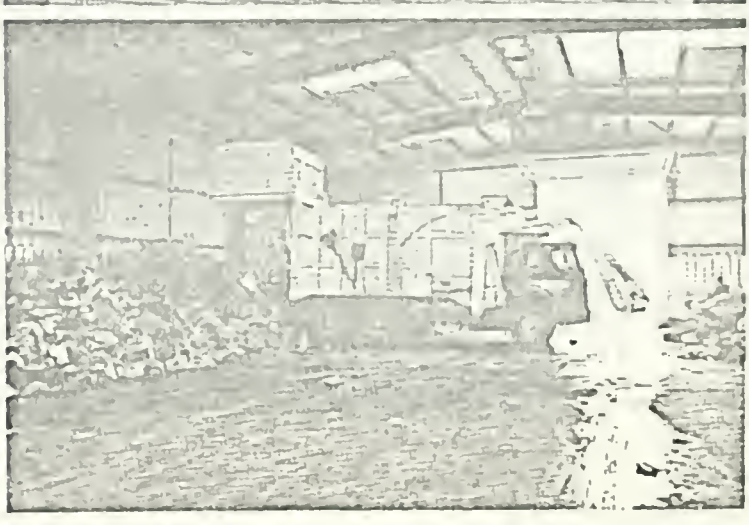


Typical Operation
Large Industri



1

2



3

A typical CONSUMAT operation is shown in the photographs on these pages. A number of years experienc has shown this to be the easiest an most straightforward operation when the application requirements are suitable. Other CONSUMAT handling methods are generally more automated. However, automation invariably results in higher capital costs and some loss of reliability even though such loss may b small. The photographs show a variety of CONSUMAT installation in order to demonstrate the adaptability of this concept to a wide variet of applications.

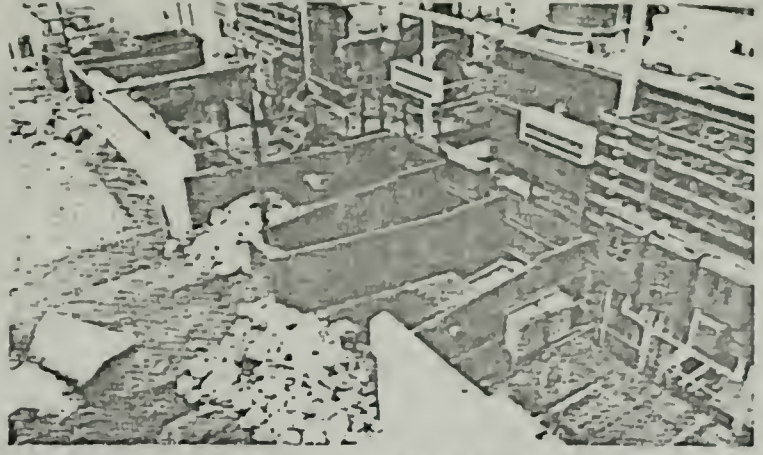
Photograph #1 shows a standard municipal packer truck being weighed in as the waste is br ht to the facility in this typical municipal installation in the state of Washington. Within an industrial complex, waste is more often delivered to the facility in dumpsters o similar containers.

The weigh-in station in photograph #2 demonstrates how the scale operator in this Arkansas installation has full view of the incoming traffic and is able to automatically record the weight of all truck entering and leaving the facility. CONSUMAT facilities in northern climates arrange the physical facilities so that a single operator can weigh-in trucks and direct the placement of the waste on the tipping flo Normally, industrial installations are processing their own waste and do not require daily weighing of the waste input.

Packer trucks deposit unsorte waste directly onto the tipping floo as shown in photograph #3 of this CONSUMAT installation.

Consumat Systems' experienc in the application of its technology to more than 40 municipal in- lla tions (not all municipal insta lo recover energy) and more than 100 industrial applications as well as t large number of smaller installatio has resulted in the accumulation extensive corporate knowhow with

Municipal or ystems



4

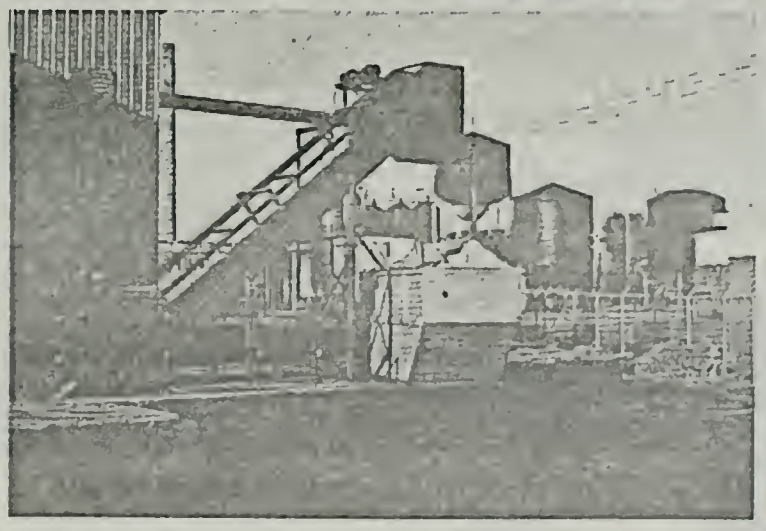
the Consumat Systems' organization.

Waste is pushed directly into CONSUMAT' loading hopper by skid steer tractors as shown in photograph #4 of a small municipal energy system. Systems larger than 300 tons per day or systems requiring large amounts of storage capacity are generally more economically fed through a pit and crane system. The tipping floor skid steer tractor arrangement, while more economical for the smaller systems, loses its economic advantage when the storage of large quantities of waste is required.

5

The operator is required only to supply waste to the system as directed by the automatic control sequences. Photograph #5 shows a typical instruction panel with its graphic loading indicators.

The waste material moves through the machine at a controlled pace and is discharged automatically through a specially designed CONSUMAT' ash conveying system for discharge into an appropriate container. In reasonably moderate climates, the discharge is recommended to be outside the facility. However, in the extreme northern climate where inclement weather and sub-freezing temperatures are present for long periods of winter, Consumat Systems recommends that this discharge apparatus be included within the enclosure of the main structure. The wet ash systems employed in the CONSUMAT' units eliminate the need for concern about dust from this operation. CSI prefers individual discharge conveyors for each module. However, in certain standard module combinations it is possible to direct the discharge from several machines into a single conveyor. This, of course, results in a lower capital cost at the expense, however, of some degree of redundancy.



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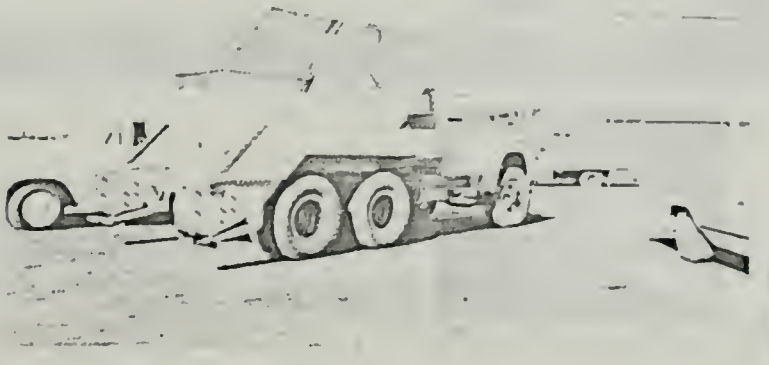
Ash is most often moved from the site to a sanitary landfill by means of a matched truck and container system. Photograph #7 shows such an arrangement.



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Sales & Service

Consumat Systems serves the entire United States and Canada through 37 independent sales organizations to provide close support for both sales and service. International sales are made through export organizations.

Engineering Services

Consumat Systems maintains a staff of engineers and draftsmen at its corporate headquarters in Richmond, Virginia. In addition to engineering support for sales and installations, the company maintains an active research and development program.

Manufacturing

Manufacturing facilities totaling over 65,000 square feet are devoted entirely to fabrication of CONSUMAT equipment. Equipment is factory assembled by trained personnel and pre-checked prior to disassembly and shipment to the job site. Patented CONSUMAT® equipment is also manufactured in France, Italy, Japan and England under special licensing arrangements.

REPRESENTED BY

WIDJAC CORPORATION
10604 N.E. 38th Pl. Suite 222
KIRKLAND, WASHINGTON 98033
(206) 828-6551

Consumat Systems, Inc.
P.O. BOX 9379 • RICHMOND, VIRGINIA 23227
PHONE: 804/746-4120

Appendix C

Financial Scenario For Project

FUNDING ALTERNATIVES
FOR
MSW STEAM GENERATING PLANT

Bonding - Using the savings.

Approximately 40% of the bond revenue could be generated through energy savings in the residence halls.

The other 60% of the savings would be in the current unrestricted portion of the budget. This portion is funded by the Legislature on an incremental type appropriation. This means that the amount in the budget for utilities, and specifically for natural gas, is based on the amount spent in the first year of the biennium, adjusted for inflation. Under normal budgeting and appropriation procedures, any energy savings during a biennium could be used for bond retirement, but when the appropriations for the next biennium were set, those savings would be cut from the budget.

Because of this budget constraint, the Legislature would have to agree to allow Western to "keep" the savings realized in its current unrestricted budget. It would in effect be allowing the use of general fund money to retire bonds instead of paying utility bills.

This would require a long term commitment on the part of the Legislature. One Legislature cannot bind a future Legislature, so a formal long term commitment would be impossible to get. However, since the make up of legislative committees is somewhat stable, a "gentleman's agreement" would be possible.

Another alternative would be the sale of state general obligation bonds, to be retired in part with the state general fund that would have been given to Western Montana College without the project. This, again would require a careful explanation to the Legislature of the savings and the advantages of the project. The savings to be realized in the residence halls would have to also be pledged to help retire the bonds.

A third, and probably best alternative would be for the College to set up an auxiliary enterprise operation to run the MSW plant. This operation would charge campus users for steam based on the amount of natural gas that would have been used. In this way the various budgets on campus would show no decrease in expenditures. The charges made to the various departments would be transferred to the auxiliary and expenses, including bond retirement paid from that operation. Such a method would still require Legislature approval or concurrence.

The Legislature should look favorably on such a project for the following reasons:

1. It is more beneficial to spend general fund on a project which will provide employment than to spend it for the use of a non renewable resource.

2. The WMC project is a good size to serve as a demonstration project for the rest of the state.

Appendix D

Grant Administration

Appendix D

Grant Administration

Grant Administration

To meet contractural agreements with the State of Montana (Contract Grant #ED-WMC-740), the following information is provided.

1. The Work Schedule: the time allotted for completion of the project is compared with what actually happened. Delays are identified and determined if they are unique to the project.

2. Budgeting: a summary of how the contract money was spent by budget category, and a list of funds that came from other sources for the project.

Work Schedule

The estimated time frame for this report was presented in the proposal submitted to the state, August 1983. It was estimated that the work would require between six and seven months to complete. It actually required 19 months to complete this report.

The report's time overrun was primarily due to scheduling difficulties and personnel changes. Scheduling delays were the result of coordinating the individuals responsible for segments of the report, confusion resulting from a delay in payment, an excessive amount of clerical errors, and a personnel change at WMC. The affect the above circumstances had on this report are explained below.

Upon the completion of the first milestone of this study, the work was submitted to the state for approval. Though the work was approved, there apparently was some confusion between the state and the engineer's office and a scheduled payment was delayed. Because of this, work on the project was halted for approximately two months.

During the course of this project the president of WMC resigned. This personnel change was unexpected and additional work loads and deadlines were placed on college representatives involved in the project. Further, portions of the work to be completed by college staff had to be completed by the engineer. This caused an additional burden on the engineering staff and required additional time.

Both of the above problems caused unforeseen time delays. These time delays caused scheduling conflicts in both the engineer's and the state reviewer's offices. It is these scheduling conflicts and excessive clerical errors which are responsible for the greatest amount of the time overrun.

After presenting two drafts of the report to the state, a third and final report was prepared and sent. However, a major clerical error in the engineer's office was made. An earlier version of the report was mistakenly

submitted as the final. This error compounded by continuing time conflicts with other projects caused the extension of the time schedule by an additional four months.

With the exception of the clerical errors, the scheduling delays were unique to this project. The problems were also of the type which are very difficult to anticipate.

Budgeting

The following is an estimated summary of the project's funding. The total budget for the project was $29,000. Of this amount the state is providing $14,500. Beaverhead and Madison counties and Western Montana College have provided the remaining $14,500 in direct funding and in-kind services. In-kind services are estimated at $6,600.

Item	Income	Expense/Profit
Contract Payments:		
Beaverhead County Payment #1	1,750	
Beaverhead County Payment #2	1,750	
Western Montana College Payment #1	1,750	
Western Montana College Payment #2	2,650	
State of Montana Payment #1	2,400	
State of Montana Payment #2	5,700	
State of Montana Payment #3	3,400	
State of Montana Payment #4	3,000	
Travel Related Expenses:		
Mileage Expenses		450
Lodging and Per Diem		300
Communication Expenses:		
Telephone Expenses		50
Postage Expenses		25
Printing: Letters & Drafts		35
Printing: Final Reports		500
Labor Costs:		
Contract Labor		2,200
Salaries/Benefits: $12/Hour for 480 Hours		5,760
Salaries/Benefits: $35/Hour for 300 Hours		10,500
Overhead & Profit:		
General Office Overhead		550
Profit		2,030

Appendix E

Bibliography

Appendix E

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